U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF SOILS
IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

SOIL SURVEY OF REEVES COUNTY TEXAS

BY

M. W. BECK, IN CHARGE, AND W. W. STRIKE

[Advance Sheets—Field Operations of the Bureau of Soils, 1922]

WASHINGTON
GOVERNMENT PRINTING OFFICE
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[PUBLIC RESOLUTION—No. 9]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture"

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]

CONTENTS

ILLUSTRATIONS

SOIL SURVEY OF REEVES COUNTY, TEXAS

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DESCRIPTION OF THE AREA

Reeves County is situated in the southwestern part of Texas, about 150 miles east of El Paso and 400 miles southwest of Fort Worth. It is irregular in shape. On the north it touches New Mexico; on the west it is bounded by Culberson County, on the southwest by Jeff Davis County, on the southeast by Pecos County, and on the northeast by the Pecos River, which separates it from Loving and Ward Counties. It has an area of 2,596 square miles, or 1,661,440 acres.

The area varies in topography from flat and undulating in the northern part to mountainous in the extreme south. About 85 per cent of the county is occupied by a broad gently sloping, somewhat undulating plain (Pl. XXIX, fig. 1) made up of outwash material from the mountains lying in the southern part of the county. The Barilla Hills in the southern part rise abruptly with steep slopes to a height of 150 to 200 feet above the surrounding plain.

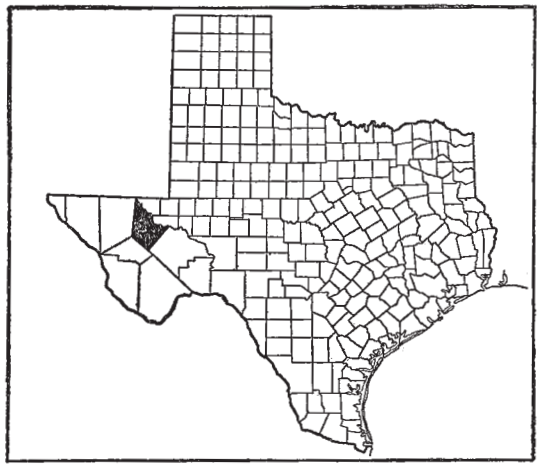

FIG. 37.—Sketch map showing location of the Reeves County area, Texas

The tops of these hills are flat, with small gullies extending back into them from the slopes. The Davis Mountains, which occupy the southern part of the county, are characterized by steep slopes, with broad deep canyons extending back into the mountains to varying distances. There are also several mesas or flat-topped elevated areas with abrupt slopes (Pl. XXIX, fig. 2) in the mountains. A number of conspicuous hills and mesas, isolated from the mountains, have resisted erosion and stand out prominently on the outwash plain. In the northern part of the county there are a number of low ridges and hills of gravel and gypsum. Several intermittent lakes occur in the west-central part of the county and to the southeast of Pecos, varying in size from a few acres to several hundred acres. Toyah Lake, the largest, lies 8 miles southeast of Pecos, and has inclosing cliffike walls from about 10 to 40 feet in height.

There is a wide range of elevation in Reeves County. The Davis Mountains range in height from about 3,000 to 5,000 feet above sea level. The plains part of the county has an elevation ranging from

about 2,400 feet to 3,500 feet above sea level. The highest part of this plain is at the base of the Davis Mountains, and the lowest point is where the Pecos River leaves the county. The elevation at Pecos is 2,587 feet and at Balmorhea about 3,200 feet above sea level.

The great plain area rises gradually toward the west, with many broad stretches appearing level. The characteristic surface of much of this plain is perfectly smooth, with areas miles in width showing no important surface inequality. Locally, however, it is faintly undulating to billowy; here and there the relief varies to gently rolling, and some areas are rolling or include low hills. The plain embraces more than 75 per cent of the area of the county, and much more than half of this is either flat or undulating to gently rolling.

The entire county is drained by the Pecos River, which forms the northeastern boundary of the county and flows in a southeasterly direction. The main tributaries of the river are Salt Creek, Fourmile Draw, Horsehead Draw, Salt Draw, and Toyah Creek. All feeders or affluents of the river flow in practically an easterly direction, except Toyah Creek, which flows northeasterly. Toyah Creek and its tributaries drain the southern part of the county and the other creeks and draws drain the northern section.

The Pecos River, the only permanent stream in the county, has a well-defined channel about 20 feet deep and about 100 to 300 feet wide, with sufficient fall to give it a moderate rate of flow. The smaller streams in the area are of the intermittent type, flowing only when there is plenty of rainfall. Most of the streams have very shallow valleys which carry flood waters by sheet flow rather than channel flow. The streams heading in the Davis Mountains have well-developed channels within the limits of the mountains, but upon debouching from these highlands they lose their channel characteristics and the water spreads out over the marginal lowlands. Toyah Creek has a well-defined channel about 50 to 100 feet wide and about 3 to 10 feet deep. The Toyah Valley varies from a few feet to about 4 miles in width. The Pecos River has developed a lowland strip subject to overflow, which ranges, on the west side, from a few feet to 2 miles in width. Nearly all parts of the county except the Hermosa Flat have depressional areas along which rainfall finds outlet.

Reeves County, originally a part of Pecos County, was organized in 1883, with Pecos as the county seat. It is thought that the Yuma Indians settled along the Pecos River in the early part of the sixteenth century. According to local information the first permanent white settler came to Reeves County about 1883 with a herd of cattle. The early white settlers of this county were all "cowmen," that is cattle raisers. Since irrigation was begun on an intensive scale there has been an influx of people from various parts of the country. According to the census reports the population of Reeves County was 1,247 in 1890, 1,847 in 1900, 4,392 in 1910, and 4,457 in 1920. The census classes the entire population as rural, there being no towns of 2,500 or more inhabitants; however, probably 90 per cent of the people live in towns and villages. The rural population is more thickly settled in Toyah Valley and north of Pecos on the Pecos River. The remainder of the county is extremely thinly settled by ranchmen. The 1920 census gives the average density of population as 1.6 persons per square mile. The

greatest increase in population was between 1900 and 1910, and was probably due to the discovery of irrigation possibilities.

Pecos, the county seat and largest town, with a population of 1,445 in 1920, is located about 1½ miles west of the Pecos River. Toyah, which is about 20 miles southwest of Pecos, has about 600 inhabitants. Balmorhea and Saragosa are two towns in the Toyah Valley, with populations of about 200 and 50, respectively, and Brogado is a small Mexican village. There are a number of other small stations along the railroads.

Reeves County has good shipping facilities. The two principal farming sections of the county, the Pecos River Valley and Toyah Valley, are served by the main line of the Texas & Pacific Railway, which connects Pecos and Toyah with points east and west. The Pecos Valley Southern Railway extends from Pecos to Toyahvale, passing through Sargent, Hoban, Verhalen, Saragosa, and Balmorhea. A branch of the Santa Fe Railway extends up the Pecos River Valley from Pecos to Carlsbad and other points in New Mexico.

The Texas & Pacific Railway was built through Reeves County in 1881 and a division point located at Toyah. The Santa Fe line was built in 1890 as a private enterprise and was taken over by the Santa Fe System in 1901. This road was originally built when it was thought the Pecos River Valley would be under extensive irrigation. The Pecos Valley Southern was built in 1909 as a local enterprise, to provide an outlet for the Toyah Valley products.

Considering the sparse population of Reeves County, the roads are good. At present (1922) 25 miles of gravel roads radiate from Pecos. The new Bankhead Highway passes through Pecos and Toyah. Work has begun on the Old Spanish Trail, which extends from San Antonio to El Paso, passing through Brogado and Balmorhea and intersecting the Bankhead Highway near the southwestern county line. Pecos will be connected with the Old Spanish Trail south of Saragosa by a graveled road.

Good schools are maintained in the four principal towns and two country schools. A number of churches are located in Pecos, Balmorhea, and Toyah. The farming and ranch sections are fairly well connected with telephone. There is no rural mail delivery in the county.

The predominant industry in Reeves County is the livestock industry, with crop growing very subordinate. The Texas & Pacific Railway maintains a division point at Toyah which furnishes employment to a number of men. Practically all products of Reeves County are shipped to eastern Texas points. A few cantaloupes are shipped from Pecos east. Pecos is a fairly good market for vegetables, and frequently the local supply is insufficient.

CLIMATE

The climate of Reeves County is similar to that of other regions in southwest Texas and New Mexico. The accompanying tables are compiled from the records of the Weather Bureau stations in Ward County and Pecos County. The conditions at Barstow, Ward County, should be practically the same as in Reeves County, except the section adjacent to the Davis Mountains. The climatic conditions at Fort Stockton, Pecos County, are practically the same as in the Toyah Valley in the vicinity of Balmorhea.

Normal monthly, seasonal, and annual temperature and precipitation at Barstow, Ward County

[Elevation 2,573 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1917)	Total amount for the wettest year (1914)	Snow average depth
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	44.9	89	0	0.50	0.00	1.46	1.0
January	46.4	89	−4	.18	.05	T.	.4
February	49.7	92	6	.26	.00	.50	T.
Winter	47.0	92	−4	.94	.05	1.96	1.4
March	57.5	98	19	.44	.05	.02	.1
April	64.1	99	26	.64	.05	.00	.0
May	72.2	106	31	.67	T.	3.93	.0
Spring	64.6	106	19	1.75	.10	3.95	.1
June	80.8	114	43	.79	T.	.75	.0
July	82.2	110	60	1.59	T.	2.14	.0
August	81.4	111	51	1.27	1.15	2.05	.0
Summer	81.5	114	43	3.65	1.15	4.94	.0
September	75.6	106	39	1.86	.95	1.40	.0
October	65.2	100	21	1.67	.00	6.59	.0
November	53.8	96	10	.77	T.	1.52	1.5
Fall	64.9	106	10	4.30	.95	9.51	1.5
Year	64.5	114	−4	10.64	2.25	20.36	3.0

Normal monthly, seasonal, and annual temperature and precipitation at Fort Stockton, Pecos County

[Elevation 3,050 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1910)	Total amount for the wettest year (1880)	Snow average depth
	°F.	°F.	°F.	Inches	Inches	Inches	Inches
December	46.3	88	6	0.72	0.03	0.34	0.6
January	46.6	90	−7	.37	.24	.14	1.0
February	50.4	95	6	.42	.22	.00	.6
Winter	47.8	95	−7	1.51	.49	.48	2.2
March	58.0	98	15	.59	.17	.15	.3
April	64.8	101	20	.68	.39	.00	.1
May	73.5	107	29	1.47	.52	.85	.0
Spring	65.4	107	15	2.74	1.08	1.00	.4
June	80.0	114	39	1.74	1.02	1.82	.0
July	81.3	110	50	1.94	.23	7.27	.0
August	80.0	109	46	2.14	T.	6.86	.0
Summer	80.4	114	39	5.82	1.25	15.95	.0
September	73.8	105	39	3.00	1.10	13.66	.0
October	64.9	102	23	1.26	.15	.91	.0
November	54.0	96	12	.74	T.	1.76	.6
Fall	64.2	105	12	5.00	1.25	16.33	.6
Year	64.5	114	−7	15.07	4.07	33.76	3.2

The winters are rather short and mild. According to the records at Barstow, January and February have mean temperatures of 46.4° and 49.7° F., respectively. The absolute maximum for the winter months ranges from 89° to 92° and the absolute minimum from —4° to 6°. The mean temperature for the winter season is 47°. Most of the winters are without snowfall. The summers are moderately long and hot, but owing to high altitude and low humidity the extreme heat is not oppressive. June and July have mean temperatures of 80.8° and 82.2° respectively, an absolute maximum of 114°, and an absolute minimum of 43°. The range between the mean temperatures of the coldest and warmest months is 37.3° or from 44.9° in December to 82.2° in July. The spring and fall seasons have mean temperatures of 64.6° and 64.9°, respectively.

The average date of the first killing frost in the fall at Barstow is November 1, and of the last in the spring, March 28. This gives a normal growing season of 218 days, sufficient to mature all crops adaptable to this section. Frosts have been recorded as early as October 19 and as late as April 17. The average first frost at Fort Stockton occurs on November 10 and the average last frost in the spring on April 2, with the possibility of frost as early as October 18 and as late as May 7.

The mean annual precipitation at Barstow is 10.64 inches. The total rainfall for 1917, the driest year recorded at Barstow, was 2.25 inches, and for 1914, the wettest year, 20.36 inches. At Fort Stockton in 1910, the driest year, and 1880, the wettest year, the rainfall was 4.07 inches and 33.76 inches, respectively; and the mean annual rainfall is 15.07 inches. The heavier rainfall here is probably caused by the influence the mountains have on precipitation, as there are very few days in summer without local showers in the mountains. There is not enough rainfall in this section in normal years for profitable farming. The greatest amount of rainfall occurs from May to October, inclusive. The winter months are usually the driest.

The climate is suited to the production of alfalfa, cotton, wheat, oats, corn, kafir, milo, feterita, cantaloupes, watermelons, grapes, tree fruits, especially pears, asparagus, and other vegetables. Their production, however, is dependent on irrigation. It is possible to produce head lettuce, cabbage, spinach, and onions during the fall and winter. The climate is also considered very healthful. There are comparatively few cloudy days during the year. During February, March, and April there are windy days, but the winds are not destructive. During the summer months there is usually a good breeze which makes the extreme heat more endurable. The prevailing winter and spring winds are from the north and west and the summer breezes are usually from the south and east.

AGRICULTURE

Agriculture in Toyah Valley possibly dates back to the early part of the sixteenth century when the Indians irrigated part of this valley. The cattlemen were the first white men to settle in this section of the State. The Davis Mountains were first utilized for pasture land by white men about 1875. The entire country was open range. Before the first windmill was erected in 1890 the cattle camps

were maintained close to streams or springs. Grazing along the Pecos River was started about 1879, according to local information. The first pasture fence in Reeves County was put up in the Davis Mountains in 1888. This part of the State has long been recognized as an important calf-producing section.

When the first white men settled in this region they found the small towns of Brogado and Saragosa populated with Mexicans, who made their livelihood by raising grain and vegetables in a crude way in the Toyah Valley by irrigation. They marketed their products at the United States Military post at Fort Davis. Irrigation on the Pecos River began about 1890.

The Mexicans, prior to the entrance of the white man, raised principally corn, wheat, beans, and peppers. A decided change has taken place in the crops grown in Reeves County since settlement by whites, and since organized irrigation began in 1907 alfalfa and cotton have been the principal crops. Cotton was introduced in 1901 or 1902; the long-staple varieties about 1916 or 1917. Cantaloupes were introduced in 1910.

The following table gives the acreage and production of the leading crops in Reeves County, as reported by the Federal census:

Acreage and production of leading crops in 1899, 1909, and 1919

Crop	1889		1909		1919	
	Area	Production	Area	Production	Area	Production
	Acres	*Bushels*	*Acres*	*Bushels*	*Acres*	*Bushels*
Corn	2,092	36,950	65	555	125	1,575
Oats			1	40	109	1,705
Wheat	50	900			412	6,196
Kafir	325	10,550	1,180	25,466	97	3,942
		Tons		*Tons*		*Tons*
Tame hay (mainly alfalfa)	1,284	3,127	907	2,740	5,452	15,033
Coarse forage	26	131	257	183	640	904
				Bales		*Bales*
Cotton			48	12	4,666	1,846

The 1920 census reported the values of agricultural products by classes for 1919 as follows: Cereals, $20,849; other grains and seeds, $8,134; hay and forage, $461,886; vegetables, $18,251; fruits, $2,868; all other crops, $371,117; poultry and eggs, $18,648; dairy products, excluding home use, $15,845; wool, mohair, and goat hair, $1,950; a total value of $919,548.

The agriculture of Reeves County consists mainly of the production of cattle, alfalfa, and cotton, which are the principal sources of cash income on the farms and ranches. Cantaloupes and watermelons are produced by a few farmers on a commercial scale in the vicinity of Pecos. The corn, kafir, and oats are consumed on the farm. Wheat is usually sold for seed. Occasionally a seed crop of alfalfa is produced and sold. Chicken raising and dairying are minor farm industries that furnish a moderate cash income.

Systematic crop rotation is not practiced. Alfalfa usually remains from 7 to 10 years; a few fields have remained in alfalfa as long as 20 years. When the crop is plowed up the land is usually planted

to cotton or reseeded to alfalfa. Occasionally wheat, oats, or kafir follow alfalfa for one year before reseeding to alfalfa. Where cotton follows alfalfa it is usually grown for three or four years.

The same general methods of growing alfalfa are employed as in other irrigated sections. The ground is flat-broken to a depth of about six inches, and if very cloddy it is irrigated. As soon as moisture conditions are right the ground is harrowed thoroughly. In case the ground becomes too dry it is again irrigated, then seeded as soon as the soil is dry enough. Practically all farmers seed their alfalfa with a drill at the rate of 10 to 20 pounds per acre. Best results have been obtained by seeding from September 1 to September 15. The first and second cuttings of the first year are usually clipped and hauled off, and as a rule 3 to 4 commercial cuttings are obtained the first year. In good years 5 to 6 cuttings are obtained. Water is applied about March 1 for the first cutting, which is generally about April 1, and after that alfalfa is irrigated as soon after each cutting as possible. A few farmers prefer to water about 10 to 15 days after cutting. A number of farmers use the alfalfa renovator or disk in the spring before the first irrigation with good results. Barnyard manure and acid phosphate have been used in a small way. The use of 16 per cent acid phosphate has given good net results according to statements of farmers. It is said by some that manuring causes alfalfa to have a longer growing season and to remain greener in winter.

Where cotton follows alfalfa the land is usually plowed in February to a depth of about 7 inches and then disked. Just before planting, the land is watered again, disked and dragged, and a middle burster (commonly known as "middle buster") is run through, making a furrow 3 to 4 inches deep. The cotton is planted 1½ inches deep in the furrow, at the rate of about one bushel per acre, around April 15. The better farmers give their cotton level, shallow cultivation every 10 to 15 days until it is laid by. Where water is available the crop is watered when it is about 6 inches high, and subsequently every 15 to 20 days. Picking begins about September 1 and continues until frost. Mebane, Lone Star, Snowflake, and Acala are the popular varieties.

Land for corn, kafir, oats, and wheat is flat-broken, harrowed, and irrigated before seeding. Corn and kafir are planted about March 15 to April 1, in shallow furrows. For corn it is essential to have plenty of water, especially during the tasseling season. Oats are sown at the rate of 2 to 3 bushels per acre either in October or February, and harvested about May 15. Wheat is sown at the rate of 1½ bushels per acre about October 10 to 15 and is harvested about June 1. Wheat and oats are watered four to six times during the winter and spring, depending on the rainfall. Where a field becomes badly infested with weeds and Johnson grass it is considered advisable to sow small grain in the fall, and, after harvesting, plow the field several times during the summer.

Cantaloupes are grown intensively in the vicinity of Pecos, where pump or artesian water is available. The ground for cantaloupes is flat-broken and laid off in 5-foot rows with a middle burster. The middles are then irrigated. When moisture conditions are right a furrow is plowed back into the trench or middle, thus providing a

shoulder to plant on. The ground is then irrigated again and seeds are planted about 3 feet apart, at the rate of two plants to the hill. Water is applied about every 10 days until the young fruit sets; after that water is applied about every six days. The vines are trained up on the ridge to keep them out of irrigation water. Cantaloupes are planted about April 15 to May 1; picking begins in 8 to 10 weeks and continues until frost. The best variety is said to be the Pollock 10–25, a strain of the Rocky Ford which has deep-orange tinted flesh. The aphis, which is about the only enemy of the cantaloupe here, is overcome by spraying with nicotine sulphate.

Watermelons, which are grown for the local markets, are planted on the level in rows 8 feet apart, hills 6 feet apart in the row, one plant to the hill. They are irrigated about every three weeks until melons put on, after that about every 10 days. Planting is done about April 15 to 30, and picking begins in 8 to 10 weeks. The best varieties are said to be the Tom Watson, Kleckley Sweets, Irish Gray, and Halbert Honey.

There are a few small orchards of Kieffer and Bartlett pears, which are grown for the local market. There are also some small orchards of Elberta and yellow cling peaches. Only 604 grapevines were reported in Reeves County in 1920. It is believed that grapes would do well here. Grapes from Barstow, in Ward County, took first premium at the World's Fair at St. Louis in 1904. Flame Tokay, Malaga, and the Muscat type are the best kinds grown at Barstow.

Black locust, chinaberry, catalpa, and cottonwood trees, Bermuda grass, roses, pomegranate, althea, euonymous, honeysuckle, figs, and many other plants do well in this region under irrigation. In growing introduced plants, especially orchard fruits and shade trees or shrubs, best results are obtained when the soil has a good mulch of straw or manure

Dairying has not received much attention. There are, however, a few small herds of purebred Holsteins and Jerseys used for commercial purposes. The cream is shipped to El Paso. Practically all farmers have one or two cows for the production of milk and butter for home use. There is not enough butter produced for the local market. The dairy cattle are fed on alfalfa and concentrates the entire year.

Cattle raising is one of the principal industries of Reeves County. The calves are usually sold as yearlings. Very few steers are kept on the ranches. Cattle are mostly shipped to Fort Worth or direct to buyers. The range cattle are practically all purebred Herefords and are fed only during extreme droughts. There are very few sheep in the county and practically no hogs. Domestic animals in 1920 constituted 31.1 per cent of the value of all farm property.

Beekeeping is an industry of some importance and is said to be profitable.

Surface relief has influenced the distribution of crops, in that the rough lands are not farmed. Soil differences have had some influence on the agriculture of the county. It is generally conceded that the Pecos River soils and the deep phase of the Reeves silty clay loam are best suited to cotton and cantaloupes, and the Toyah Valley soils are best adapted to alfalfa. The Balmorhea clay is deemed the best

alfalfa soil. The Pecos River soils, where the alkali content is not too high, are considered better for cotton than alfalfa. The Toyah loam and Toyah fine sandy loam are said to be the better fruit soils.

Soil differences control the acreage of improved land. Where a high alkali content is present or where the soils are extremely heavy the improved farm area is considerably smaller than on the lighter types and those of low alkali content. The 1900 census reported 63 farms in the county, having an average size of 14,226.5 acres, with 0.9 per cent improved, or 127.2 acres of improved land per farm. The 1920 census reported 206 farms with an average of 5,100.6 acres per farm, 1.6 per cent improved, or 79.5 acres of improved land per farm. In the Toyah Valley a 40-acre tract is the predominant holding for an individual, although some tracts contain 400 to 600 acres. The usual farm area of improved land on the Reeves soils is 40 to 160 acres. Practically all of the Pecos River lands are held in half-section and section tracts.

The 1900 census report showed 65.1 per cent of all farms operated by owners, whereas the 1920 report showed 68 per cent operated by owners, 30.1 per cent by tenants, and 1.9 per cent by managers.

Practically all the farms are supplied with modern implements, such as sulky and walking plows, spike-tooth harrows, drags, alfalfa seeders and renovators, reapers, rakes, and binders where small grain is raised. As a rule three or four horses of medium to heavy draft types are used. There are also several gasoline tractors in use. According to the 1920 census the equipment of farm machinery constituted 2.9 per cent of the total value of all farm property.

Improved farm leases are either on the share basis of one-fourth of the cotton and one-third of the other crops where the tenant furnishes everything but land, or on equal shares where the landlord furnishes land and equipment and half the seed and the tenant furnishes half the seed and all the labor. A few farms were operated by hired labor at $20 to $30 a month, at the time of the survey (1922). Ranch land at this time was leased at 5 to 10 cents an acre.

Land in the Toyah Valley irrigated district was held in 1922 at around $100 to $250 an acre. Unimproved land adjacent to the Toyah irrigated district was reported as selling for about $10 to $15 an acre. Improved land with water right on the Pecos River was quoted at around $75 to $100 an acre and unimproved at about $15 to $30. Farms with pumping plants in operation on the Reeves and Verhalen soils were quoted at $100 to $150 an acre. The Davis Mountain ranch land was reported as being held at about $2 to $3.50 an acre. The Verhalen soils for ranching were quoted at about $2 to $5 an acre, and the Reeves soils at around $1 to $2.50.

The buildings on the average farm consist of a substantial frame home and small barns. Where a pumping plant is maintained the pump is housed in a good building. Implement sheds are rather uncommon. In 1920 the buildings represented 4.1 per cent of the total farm value. The ranch headquarters usually consists of a house, barn, and windmill.

There was generally plenty of labor available for farm work at the time the field work on the survey was being done. Mexicans were usually employed for chopping cotton by the acre. When employed by the day they received 75 cents to $1.25. White men employed by

the month received from $15 to $40, with the use of a house. During the periods of harvesting and baling hay crews go about baling hay by the ton. The owner of the hay cuts it and moves it to the baling machine.

Commercial fertilizers are not used to any important extent. No farms reported the use of fertilizer to the census of 1900 or 1910. The census of 1920 gave nine farms reporting the use of fertilizer, valued at $1,208, or an average of $134.22 per farm. The principal fertilizer used is 16 per cent acid phosphate. This is applied to alfalfa at the rate of 200 to 300 pounds per acre. Very little barnyard manure has been available, but where used it is said to have given favorable results. On the Reeves soils good results have been obtained by plowing under green crops, especially cowpeas.

SOILS

The parent materials from which the upland soils of Reeves County have been developed consist chiefly of alluvial-fan deposits transported from the highlands to the west by migrating streams, and spread out to form the great sloping plain which constitutes the principal topographic feature of the county.

In the mountainous part of the county the soil materials have been accumulated by the decay in place of a series of limestones, sandstones and igneous rocks, and in the river valleys the material is alluvial.

The soils of Reeves County have been developed under the influence of a low rainfall and a prevailing relatively high temperature. The rainfall is too low for the complete removal from the soil of the soluble products of decomposition. In places where drainage waters collect, such products have accumulated to a concentration high enough to injure plants. In practically all other places the salt content in the soil has been sufficient to cause the development of a characteristic soil profile. This is true only of those soils that are old enough to have become modified by local conditions. It is not true of the soils which consist of recently accumulated sediments and those made up of very sandy or gravelly material. The heavier and medium textured soils of the alluvial-fan plain constituting most of the area of the county are marked by this profile.

The profile of the mature soils consists of—

1. A thin crust, usually smooth at the top but rough on the under side, the roughness consisting of pellets varying in size from a millimeter or less up to 2 or 3 millimeters in diameter. The thickness of the crust ranges from less than a quarter of an inch to about half an inch.

2. A layer of granular particles. The particles range in size from small siltlike material up to a quarter inch in diameter. This layer may range from a fraction of an inch to 3 or 4 inches in thickness.

3. A layer of compact material, not compact enough to make plowing difficult. It is not impenetrable to moisture and is compact merely in contrast with the looseness of the overlying layer. As a rule it has good water-holding capacity and is the seat of most of the roots of the grasses and herbaceous plants. It is usually free from injurious accumulations of salts and has a faint to well-developed

columnar breakage; but when plowed for the first time or after a period of several years of fallow it breaks up cloddy. It is usually browner in color than the surface crust or the granular layer. It ranges up to about a foot, or slightly more, in thickness.

4. A layer of material that may be loose when compared with the more compact material overlying it, with spots of concentrated lime carbonate or gypsum, or the lime carbonate or gypsum may be concentrated into a marly or consolidated layer. This horizon of chemical concentration ranges up to several feet in thickness. The zone of lime or gypsum accumulation does not usually lie at less than 2 to 3 feet from the surface.

5. The parent material, consisting mainly of alluvial-fan wash, but may consist of material accumulated by the residual decay of the various consolidated country rocks.

Practically all of the plains soils effervesce freely with hydrochloric acid. Sulphate of lime is present in the soil in many places in the form of crystals and in massive form. Large areas are underlain by beds of almost pure crystalline gypsum, frequently in beds many feet thick. The most extensive type of soil, the Reeves silty clay loam, is underlain at depths ranging from a few inches to 5 feet or more by a chalky material composed chiefly of the carbonate and sulphate of lime. This may have been formed in a manner much the same as that accounting for the vast areas of caliche underlying, at shallow depths, the soils of the Great Plains region from Mexico northward into Canada. In places it outcrops at the surface and constitutes the soil type mapped as Reeves chalk.

Another peculiarity of these soils, as compared with the soils of humid regions, is the high content of water-soluble salts, those commonly referred to as "alkali." Tests made in various localities show a content range of these salts in the upper 6 feet, from around 0.1 to more than 1 per cent, the highest amount being found where the soil is shallow over chalky material. These salts consist chiefly of sodium chloride, sodium sulphate, magnesium sulphate, and magnesium chloride.

Structurally, the soils of this plains section show in places a well-developed thin crust, ranging from about one-sixteenth to about 1 inch in thickness. This is fairly compact in places; in other places it is fragile and breaks down readily to a pelleted or even a powdery condition. Locally in the dry soil there is a crumbly to powdery, or deflocculated layer beneath the crust, ranging in thickness from about 1 inch to 4 or 5 inches. Or this subsurface horizon may consist of material which in places is slightly compact, but is reducible with moderate pressure to a somewhat pelleted structure. Beneath the subsurface layer the material is usually dense or moderately compact, and in the dry condition is very difficult to bore into with a soil auger, even in the underlying chalky horizon. The sandy soils usually have a thin surface crust, but the very gravelly soils are not so noticeably crusted, probably because of their coarse texture.

The cemented condition is not found everywhere. In many places the soil can be scooped up with the hands in a crumb, crumb-dust, or pelleted condition to depths ranging from less than an inch to 3 inches or more. Beneath this lower layer the material is generally compact, sometimes slightly cloddy down to about 8 inches. As a

rule, however, these soils crack very little or none at all, even in case of the heavier types.

In the escarpment about Toyah Lake, and in some other places, a distinct columnar structure is to be seen in the heavy subsoil material, to depths of about 2 feet or more.

The prevailing color of the soils of this region is brownish gray to light brown in the surface horizon, frequently showing a pale-buff cast; the layer beneath is brownish gray to pale yellow, with a very faint pinkish cast; and beneath this the color is pale buff, light pinkish, or salmon to pale yellow with a pinkish cast. The more nearly pure chalk layer tends more to cream color or whitish, but even the pure chalk has a pinkish or buff tint in many places. The color of these soils apparently has little or no relation to the color of the parent material. Some associated soils, the Verhalen, are much redder than the most pinkish phase of the Reeves. These range from chocolate brown to dull red at the surface and from salmon to pink in the subsoil. This reddish color also is a soil-developed color, apparently, rather than a parent-rock color.

In the Davis Mountains, the Barilla Hills, and the hills in the vicinity of San Martine, very different soil conditions prevail. Here the soils are shallow and very stony, the soil in many places having been removed about as fast as the parent rocks have decomposed. From the light-colored limestone rocks of the hills and part of the Davis Mountains light-brown and grayish soil material overlying chalky (caliche) subsoil material is commonly formed. From the crystalline rocks of the Davis Mountains purplish-brown to reddish shallow soil is formed, which has a color much like the rocks from which it is derived. Very gravelly soil along the base of these mountains, representing outwash material, has also a purplish color, similar to the soils of the more stony areas above.

Organic matter has contributed some degree of color to the immediate surface soils, more so in the hill and mountain lands, where there is more gray than in the plains types, which appear to be very low in content of organic matter.

The recent-alluvial plains along all the streams except the Pecos River are composed of material which has been washed from the higher, older soils of the surrounding country. The color is darker than that of much of the parent material, apparently from accumulations of organic matter. The flood plains of the Pecos River are occupied by soils whose parent material has been washed in part from the purplish-red or Indian-red Permian Red Beds or similarly colored rocks occurring within the drainage basin of that stream. Of course there is much intermingled material from soils which are not red; in places, indeed, a large proportion of the surface soil has recently been washed down from near-by upland areas of light-colored soils, and the present color is not markedly different from that of the soils from which the material has been transported by water. Nevertheless, prevailingly the deep subsoil of the Pecos River alluvium has a peculiar chocolate-reddish or pinkish color which seems to be due to the rock color of the soils from which a considerable part of the alluvium is derived. The upper layers are in places of a chocolate-reddish color also, but in some places the accumulation of organic matter from vegetation under favorable mois-

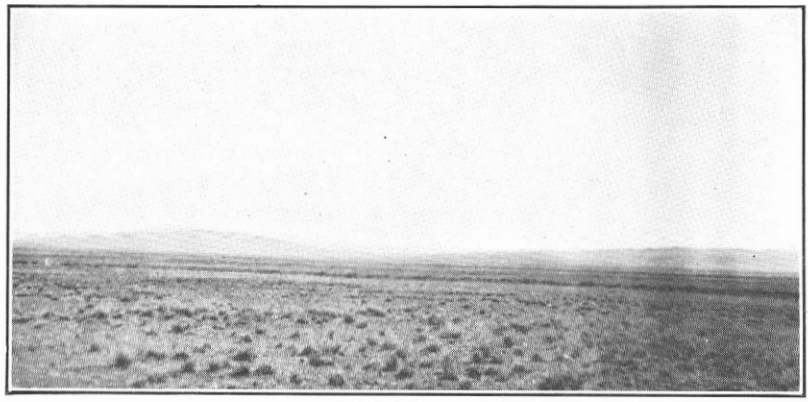

FIG. 1.—OUTWASH PLAIN ON WHICH OCCURS VERHALEN CLAY

Davis Mountains in the background

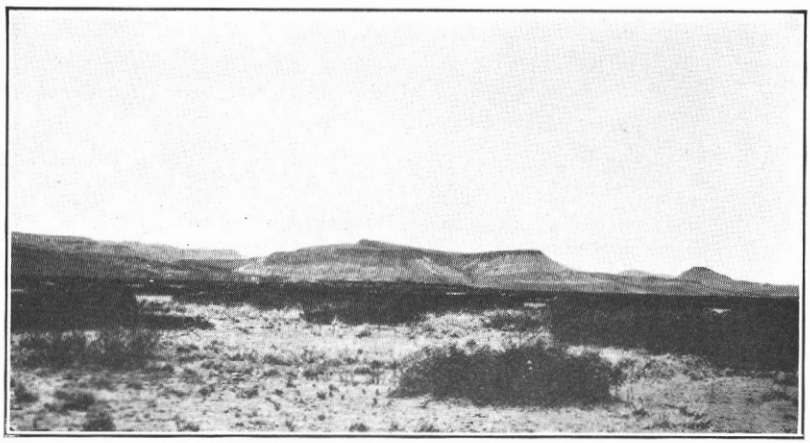

FIG. 2.—MESAS RISING ABRUPTLY FROM THE MARGIN OF THE PLAIN

ture conditions has given rise to dark-colored soils, and the reddish material is found only at depths of 3 or 4 feet or more.

Four major groups of parent material have played an important part in supplying the soil materials of the county—(1) the outwash plain materials, (2) the highly varied igneous crystalline rocks of the Davis Mountains, (3) the Comanchean limestone of the Edwards Plateau, and (4) the Permian Red Beds (or closely related sedimentary rocks).

On the basis of differences outlined above, the soils of the county are classified into groups, designated as soil series. A soil series consists of soil types, which are similar in all respects except the textures of the surface horizon. The soil type is the unit of classification and mapping.

The light-colored soils of the uplands, which cover about 90 per cent of the area of the county, are members of the Reeves series. The reddish soils, whose component material appears to have been derived in part or largely from soils derived from igneous rocks, have been classed in the Verhalen series. Much igneous rock gravel is associated with these soils.

The soils of the Reeves series (when dry) are characterized by brownish-gray to light-brown surface soils. In the heavy types the material passes at depths ranging from about 6 to 28 inches, and in places 36 inches, into light-buff, pale-salmon or whitish material of a chalky consistency, and commonly containing gypsum crystals. In places the lower layer is hard, and is known as caliche, or as concrete where it contains gravel. On drying, a thin crust, an inch or less in thickness, is formed in places, and below this a somewhat crumbly or fine cloddy layer extends to about 6 inches, where the material is more dense. Locally well-rounded gravel and even cobbles of quartz and other vari-colored rocks are abundant from the surface down to great depths, and fragments of the caliche layer are scattered over the surface in places. All the material is rich in carbonates and effervesces freely with hydrochloric acid. The material from which the Reeves soils are derived has been washed from the highlands to the west. Since its transportation and deposition by water, some organic matter has accumulated from the sparse growth of greasewood, small sage, and scattered mesquite and grasses. Also there probably has been some change in the amount and distribution of water-soluble salts and some development of structural features. The color of the soil is lighter brown than that of the Richfield soils and the content of carbonates in the upper layers is much higher. The surface of the heavy type areas is flat and slopes very slightly toward the east. The gravelly and sandy types have a more uneven surface.

The Verhalen series includes types with chocolate-brown to reddish-brown or dull-red soils, underlain at variable depths by whitish to salmon-colored or light-pinkish material of a chalky consistency, or by hard calcareous beds, locally called concrete, but sometimes referred to as caliche. The material is rich in carbonates from the surface down, effervescing freely with hydrochloric acid. These soils are derived from material which has been washed out from the igneous rocks of the mountains to the west, and spread out as flat to

undulating plains. The soils superficially resemble the Amarillo soils, but are much higher in content of carbonates in the upper section. Usually the material is stiffer below about 5 or 6 inches, in the heavier types, and more reddish. Generally there is only a thin surface crust over the dry soil, and under this the material is crumbly to fine cloddy. Gravel of crystalline rocks, usually reddish and rusty brown in color, is abundant in places. Tobosa grass carpets many areas of the heavier types.

The Ector soils in Reeves County are characterized by brownish-gray to whitish loamy to chalky surface layers, with an abundance of limestone fragments, grading within a few inches into cream-colored loam to light buff-colored gravelly silty clay loam. The Ector soils are derived from the underlying limestone, and occupy eroded slopes and ridges of the Edwards Plateau. They differ from the Reeves soils in their mode of formation, and in not having a well-defined caliche or chalky substratum. They are highly calcareous, but do not contain the conspicuous amounts of gypsum found in the Reeves types.

The alluvial soils along Toyah Creek, whose component material has been washed largely from igneous rocks, have been classified in the Toyah and Balmorhea series. The alluvial soils along the Pecos River have been grouped in three series, the Pecos, Arno, and Patrole.

The Balmorhea soils are very dark brown to black soils, underlain by brown, yellowish-brown, or dark yellowish-brown friable subsoils, in places passing into a yellowish-brown sandy loam layer at about 20 to 30 inches. Usually there is a gradual change from the very dark-brown surface soils into dark-brown, brown, and finally yellowish-brown color. In some places the lower section is heavy textured instead of sandy. Some whitish granular material, apparently gypsum, is present in the subsoil. These soils are of alluvial origin, the material having been washed from the area of crystalline rock highlands of the region. They are rich in carbonates, chiefly lime carbonate.

The soils of the Toyah series are characterized by their brown surface soils of mellow consistency, passing at about 8 to 14 inches into chocolate-brown or brown, somewhat stiffer material. The lighter-textured soils are of lighter brown color. There is not much change in the subsoil downward. The lime content is high. These are alluvial soils derived from wash from the crystalline rock highlands of the region.

The Arno soils are chocolate brown to chocolate red in color, with whitish gypsum in the subsoil. In places brownish to greenish layers are encountered in the subsoil, but typically the bulk of the material through the vertical section is reddish brown or chocolate red, except in case of the very sandy types, which are more brownish and less reddish. All the material is rich in lime carbonate, effervescing freely with hydrochloric acid. These are first-bottom alluvial soils composed of material derived from outwash-plain and Red Beds soils. They are much like the Miller soils, but contain more gypsum and water-soluble salts.

The Pecos soils are typically dark brown to black in the surface soil and chocolate brown to chocolate red in the subsoil, the latter

resembling Miller material. The subsurface layer is often olive brown in color. Gypsum is common in the subsoil, and the material is rich in carbonates from the surface downward, effervescing freely with hydrochloric acid. Some areas carry enough alkali to injure crops. These are first-bottom soils, the material of which probably has been washed largely from the outwash plains, soils of the Pecos valley, and Red Beds, the material from the latter giving rise to the chocolate-red subsoil.

The Patrole series includes soils having an ashy-gray color, in places mottled with rusty brown, overlying (1) bluish to greenish-gray chalky material containing considerable soft gypsum or (2) dark-gray material, mottled with rusty brown and yellow; this passes at depths ranging from about 15 to 30 inches into chocolate-red, dark chocolate-red, or chocolate-brown clay containing gypsum. In places there is a thin surface layer of recently deposited chocolate-reddish alluvial material. These soils have been derived partly from alluvium deposited by the Pecos River and partly from sediments washed in from near-by uplands of Reeves soils. The soils are rich in lime carbonate. The surface is flat and the underdrainage is imperfect.

There are several intermittent lakes in this county varying from a few acres to several hundred acres in size. These contain water only following periods of heavy rainfall, and some of them have no outlets. They occur within areas of gypsum chalk. The soil material is of variable character both as to texture and color. The predominating surface material is light-brownish, pale-buff, and cream-colored silty clay loam, containing some sand. This passes quickly into whitish clay or buff-colored clay to silty clay, containing some sand crystals of gypsum. The material is extremely salty and has the characteristic odor of salt marshes. The surface is perfectly flat, and also appears level to the eye. No vegetation occurs on these inhospitable salt flats.

There is a very close relation between the soils and the vegetation in Reeves County. The different grasses and shrubs seem to be closely associated with the different soils.

The mesquite of Reeves County attains only a low growth, except in moist low places, where it grows to a height of 6 to 10 feet. Salt cedar grows to a good height. Cat's-claw, screw bean, greasewood, and all other brush vegetation is rather low and spreading in habit.

The four distinct grasses which are valuable for grazing are the burro grass (*Scleropogon brevifolius*), salt grass (*Sporobolus airoides*), tobosa grass (*Hilaria mutica*), and grama grass.[1] The burro grass is confined largely to the upland of the county north of the Texas & Pacific Railway. Tobosa grass is confined strictly to the Verhalen soils, and grama grass is found only in the Davis Mountains. The salt grass grows throughout the Pecos River bottoms and on practically all the area of the shallow variation of the Reeves soils. The distribution of salt grass seems to depend more on the alkali content than other soil characteristics.

[1] Botanical names from specimens identified by F. V. Coville, of the Bureau of Plant Industry, and other botanists.

Those areas of the Reeves silty clay loam having chalky material within about 2 feet of the surface are usually covered with salt grass, narrow-leafed sage (*Lycium torreyi*), allthorn (*Koeberlinia spinosa*), and mesquite. The deep phase of the same type supports little vegetation other than greasewood or creosote bush (*Covillea tridentata*), a broad-leafed sweet-smelling sage (*Fluorensia cernua*), and burro grass. The creosote and sage bushes on this type attain a height of about 2 feet, and their distribution is nearly equal. On the Reeves chalk there is practically no grass and only a sparse covering of cat's-claw and creosote bush, with very little mesquite, buckthorn, and bear grass. Creosote bush and scattering mesquite predominate on the Reeves gravelly loam, whereas screw bean and cat's-claw predominate on the very gravelly phase of this type.

The Verhalen clay is covered completely with tobosa grass, and is free from all brush vegetation. This type, in the virgin state, can be identified at a distance by its full covering of tobosa. The vegetation on the Verhalen gravelly clay loam consists mainly of screw bean, cat's-claw, and mesquite. The alluvial soils of Toyah Creek are also covered with tobosa grass, except where alkali favors the growth of salt grass.

Juniper and algerita are confined strictly to the mountainous sections. Salt cedars are a natural growth on the Pecos River lands.

The soil types mapped in Reeves County are described in detail in subsequent pages of this report. Their distribution is shown on the accompanying map and their extent is given in the following table.

Areas of different soils

Soil	Acres	Per cent	Soil	Acres	Per cent
Reeves silty clay loam	128,768	33.2	Toyah silty clay loam	18,688	1.1
Deep phase	421,568		Arno very fine sandy loam	15,616	.9
Reeves gravelly loam	395,840	27.0	Verhalen loamy fine sand	15,296	.9
Very gravelly phase	52,800		Toyah loam	14,016	.8
Verhalen clay	201,280	12.1	Toyah fine sandy loam	8,704	.5
Verhalen gravelly clay loam	115,264	6.9	Pecos clay	5,440	.3
Rough stony land	74,176	4.5	Balmorhea clay	3,392	.2
Reeves chalk	72,704	4.4	Patrole silty clay loam	1,984	.1
Reeves gravelly fine sandy loam	49,216	3.0	Pecos silty clay loam	1,024	.1
Ector gravelly loam	23,040	1.4			
Reeves fine sandy loam	22,400	1.4	Total	1,661,440	
Arno clay	20,224	1.2			

REEVES GRAVELLY FINE SANDY LOAM

The Reeves gravelly fine sandy loam is a light-brown to yellowish-brown gravelly fine sandy loam, 8 to 10 inches deep, underlain by a light yellowish-brown or light buff-colored gravelly fine sandy clay extending to depths of about 15 to 36 inches or more. Chalky material underlies this in many places, and "concrete" is locally present. The soil and subsoil contain considerable gravel, mainly of limestone, though rather compact in place. The material effervesces freely with hydrochloric acid.

The type is not very extensive, occurring only in isolated areas north and east of Fourmile Draw. It usually occupies slopes and well-rounded ridges. The drainage is good, but the soil is retentive of moisture.

This type is used entirely for pasture land. There is a rather sparse growth of chaparral, mesquite, bear grass, Spanish dagger, buckthorn, and cat's-claw, and also a thin covering of needle and burro grasses and weeds. The soil has about the same value for pasture as the Reeves fine sandy loam, and it leases and sells for the same price.

REEVES GRAVELLY LOAM

The Reeves gravelly loam consists of about 6 to 12 inches of grayish-brown, light-brown, or yellowish-brown gravelly loam, underlain by light-buff gravelly loam, which passes into whitish chalk of high gypsum content at depths ranging anywhere from 10 to 40 inches. The surface is strewn with gravel or quartz and varicolored pebbles, along with whitish fragments that appear to represent limestone hardpan (caliche) or conglomerate. In a number of small local areas the soil is a very gravelly, buff-colored loam, ranging to chocolate reddish brown, with a conglomerate or caliche at rather shallow depths, and fragments of caliche scattered over the surface in places.

The Reeves gravelly loam is one of the most widely distributed types in the county. It is most extensive in the eastern part. There are also large areas north and northwest of Pecos, and many smaller areas throughout the northern part of the county. This type usually predominates on the broadly rolling country. Its topography varies from gently undulating to ridgy. In many places the surface is gently rolling, with long rather gentle slopes and broad depressions. It is thoroughly drained.

This land is utilized for pasture. The natural vegetation is mainly greasewood (or creosote bush) and scattering mesquite, with some cat's-claw, screw bean, and little buckthorn. There is also a sparse growth of burro grass and salt grass, and some weeds. Northwest of Pecos there is considerable bear grass, Spanish dagger, and needle grass.

This type of soil supports about 5 to 10 head of cattle to the section, according to local estimates. At the time of the survey it was valued at about $1 to $2 an acre, with leases available for $50 a section.

The Reeves gravelly loam, as mapped, includes a number of steep, eroded slopes, where the soil is a shallow, light-brown gravelly loam underlain by white or buff-colored, gravelly chalky material many feet deep. In places yellowish streaks appear in the subsoil, which seem to be high in sulphur. These eroded slopes occur principally along the escarpment bordering the Pecos River bottoms about 20 miles north of Pecos. In a few small areas the soil is very gravelly. These eroded slopes have no apparent agricultural value as they are practically bare of vegetation.

Reeves gravelly loam, very gravelly phase.—The very gravelly phase consists of about 6 to 10 inches of grayish-brown or brownish-gray very gravelly loam, underlain by gray or whitish gravelly clay loam or chalk containing considerable gypsum. In places beds of concrete are encountered at depths of 20 to 40 inches. This soil is distinguished from the typical Reeves gravelly loam by its dense covering of gravel, consisting chiefly of quartz, quartzite, and various

igneous rocks. The surface is so thickly strewn with gravel that in places no soil is visible.

The total area of this soil is not large. The prinicipal bodies are those southeast, south, and southwest of Toyah. Numerous small areas occur throughout the region underlain by gypsum beds.

The topography is characterized by low ridges and hills. The phase lies slightly above the adjacent soils. The drainage is thorough.

This phase is covered with about equal growths of screw bean, greasewood, and cat's-claw, with a few scattered mesquite bushes. There is practically no grass and only a few weeds. Yucca is locally common. All of this land is used for pasture.

REEVES FINE SANDY LOAM

The Reeves fine sandy loam consists of light-brown to light-buff fine sandy loam, often rather heavy, underlain at about 8 to 10 inches by yellowish-brown to brownish-yellow, heavy fine sandy clay or fine sandy clay loam, which extends to depths of 30 to 40 inches or more, where whitish gypsum usually comes in. Both soil and subsoil are compact in place, but loosened fragments are friable. The material effervesces freely with hydrochloric acid. The content of organic matter is low. Locally the surface is covered with a crust from one-eighth to one-half inch thick. In places the chalk material is encountered at 15 to 20 inches, and in such places the subsurface layer and the upper part of the chalky layer are more pinkish or salmon colored and alkali spots may be present.

A few areas of the typical Reeves silty clay loam and Reeves gravelly loam are included. There are also a few areas where wind has piled small dunes of fine sand around the bases of shrubs. In the more hummocky areas the soil on the mounds is generally somewhat coarser in texture and slightly lighter and more yellowish in color.

The Reeves fine sandy loam is not very extensive. The largest areas are north of Fourmile Draw, with a few areas in the vicinity of Pecos. The surface is mainly gently undulating, and the drainage is good.

The native growth consists largely of mesquite, chaparral, bear grass, Brigham Young weed, and a sparse covering of greasewood. The principal grasses are burro, needle, and black grama. There are numerous weeds.

The type is used exclusively for pasture. This soil withstands drought better than the heavier soils. A section of this land supports about 10 to 15 head of cattle, according to local estimates. It was held at the time of the survey for about $1 to $2 an acre, and leased for about $50 a section.

With available water for irrigation, this soil would produce good yields of vegetables, cantaloupes, watermelons, and cotton.

The type includes some areas of a peculiar gypsum "sand," consisting of pale-yellowish to whitish sand or loose fine sand to a depth of 36 inches or more, practically without change in color or texture. Usually the surface has a compact crust, one-quarter to one-half inch in thickness. Both soil and subsoil effervesce with hydrochloric

acid, the subsoil more freely than the soil. The material consists of small fragments of gypsum crystals. It has a distinctly gritty or sandy feel, but practically no grit is detected by chewing.

This variation occupies a few small areas, the principal one being on the northeast edge of Toyah Lake. It has typical dune topography and drainage. On the higher positions it supports a sparse covering of Spanish dagger, bear grass, some mesquite, and Brigham Young weed, but very little grass. The intermound vegetation consists of weeds, sagebrush, tickle grass, and some yucca. The land is used only for pasture.

REEVES SILTY CLAY LOAM

The dry Reeves silty clay loam in its more outstanding characteristics consists of light-brown, brownish-gray or faintly buff colored silty clay loam, underlain at depths ranging from about 4 to 28 inches by pinkish chalky material, which extends to depths of 36 inches or more. The pinkish subsoil is usually hard and difficult to bore into, although it is usually very chalky and contains gypsum crystals. The material effervesces freely with acid. The soil is smooth to the feel and friable when dry, but very sticky and slick when wet. It tends to run together when wet, and to form a thin surface crust on drying, usually about 1 inch thick. Beneath this there is in many places a brownish-gray to pale-buff, crumbly layer about 5 inches thick, this being underlain by denser material.

A number of variations are mapped with this soil type. Some included areas contain a little gravel in both soil and subsoil. In some places the surface soil is slightly sandy. There are also occasional small dunes representing wind-blown material collected around bushes. In places, especially adjacent to the deep-phase areas, there is usually a layer of yellowish-brown silty clay loam, containing some gypsum crystals, immediately above the white chalk. Locally the soil is more pinkish or buff colored. In a few places the subsurface material consists of chocolate-brown or buff-colored silty clay loam to silty clay.

A shallow variation consists of 6 to 10 inches of brown silty clay loam, underlain by white to pinkish chalky material. This soil usually has a surface alkali crust one-fourth to one-half inch thick. In some depressed areas the surface is rather dark in color. In places the surface soil contains numerous crystals of gypsum. This variation occurs at Pecos, near Toyah Lake, and in a few other places adjacent to the first bottoms of the Pecos River and other streams, usually along the outer margin of the first bottoms. The surface is flat, and the water table frequently stands at depths varying from almost at the surface to about 2 feet. On a small farm on this variation, cantaloupes appeared to be successful, and cabbage, watermelons, and tomatoes were grown in a small way. This soil has a high content of alkali salts. It is covered with salt grass, scattering mesquite, and a sparse growth of salt-loving plants, and is used for pasturing cattle.

The Reeves silty clay loam has a rather extensive development in the county. The largest area is in the vicinity of and to the south of Pecos. A rather large area lies in the west-central part around John-

son Lake, and a number of smaller bodies occur throughout the northern part of the county.

The characteristic surface is level to faintly undulating. The soil dries out badly in dry weather. There are sink holes in places in the gypsum substratum, which would interfere with irrigation.

The Reeves silty clay loam has not been used to any great extent for farming. A few abandoned farms are seen here and there. The entire area is covered with mesquite, sagebrush, greasewood, allthorn, salt grass, and a variety of weeds. Practically all of the type is devoted to pasture.

This type of soil was selling for about $1.50 to $5 an acre at the time the survey was made, and was leasing at 5 to 10 cents an acre for ranching.

Reeves silty clay loam, deep phase.—The deep phase differs from the typical Reeves silty clay loam principally in the greater depth to the chalky gypsum layer. Generally the soil consists of light brownish-gray, light-brown or buff-colored silty clay loam to a depth of 6 to 12 inches, where it grades into the subsoil of light-buff or yellowish-buff silty clay loam. As a rule this extends to a depth of 3 feet or more, but in some areas the chalky gypsum is reached at a depth of 26 or 28 inches. Whitish and pinkish gypsum particles are present in the subsoil in places. Both soil and subsoil effervesce freely with hydrochloric acid.

The texture of this soil is a fairly uniform silty clay loam, except that the subsoil varies locally to a silty clay. There are some variations in color. In places the surface soil is light reddish brown, chocolate brown, or chocolate reddish in color. The chocolate-brown color is found mainly in level or slightly depressed areas. Locally the material has a uniform buff color throughout the 3-foot depth. In a few places the subsoil is brownish or reddish brown in color. A little gravel is present on the surface here and there. Some areas are marked by the presence of low wind-blown mounds consisting of sandy material.

The soil is low in content of organic matter. It crusts rather badly after irrigation. When plowed in the dry state it breaks up in large clods, but these are easily broken down with disk and spike-tooth harrows.

The deep phase of the Reeves silty clay loam is an extensive soil and occupies several large tracts. The largest area lies west of Pecos in the vicinity of Hermosa. There is a good-sized area at Toyah, and several smaller bodies occur throughout that part of the county which is underlain by the gypsum beds.

The surface is characteristically flat (Pl. XXX, fig. 1). To the eye it appears level, but there is enough slope for good surface drainage. In places there is a hardpan formation at depths of about 8 or 10 feet, which might interfere with internal drainage in case the land is irrigated.

The deep phase of the Reeves silty clay loam is not important agriculturally. It has been used for farming mainly in the shallow-water belt west and south of Pecos. A number of abandoned farms were seen at the time the survey was made, and a few farms were operating successfully. If a favorable supply of irrigation water by gravity from the Pecos River were developed, it is possible that much

of this land could be put under successful cultivation, provided good underdrainage is assured. More than 95 per cent of this soil is still covered with its natural vegetation. This consists of a broad-leafed, sweet-scented sage (*Fluorensia cernua*), and creosote bush (*Covillea tridentata*). These two bushes grow to a height of about 2 feet and are about evenly distributed. The predominating grass is the burro grass (*Scleropogon brevifolius*), which thinly covers the ground. The growth includes also some needle grass and a number of weeds.

This soil is valued most for the production of cotton, cantaloupes, and alfalfa. Cotton following alfalfa is reported to have produced 1 to 1½ bales per acre. The Acala variety is said to have given 1½ bales, and Lone Star and Mebane made from one-half to 1 bale per acre. The Durango variety in 1921 did not give good results. Alfalfa produces, according to local estimates, from 3 to 5 tons per acre; cantaloupes from 100 to 200 crates; and kafir from 30 to 40 bushels. Cantaloupes and cotton are sold as cash crops. All the alfalfa is sold except that needed for the work stock and the few dairy cows. The kafir and milo are fed to stock on the farm. Cotton and alfalfa are grown on about an equal scale, but the other crops mentioned occupy only a small acreage. Unimproved land supports about 15 to 20 head of cattle to a section.

The soil of this phase is rather slow to take up water. According to the experience of some, the land should be irrigated in the rough, that is, in the cloddy state, after plowing. After applying about 9 inches of water the ground is thoroughly pulverized and seeded. It has also been the experience of successful growers, that it is best not to apply additional water for cotton until the plants are 3 or 4 inches high. The irrigation checks on this type probably should not have over 0.1 foot fall per 100 feet.

Cotton is planted in a slight furrow about April 15 to May 1. Alfalfa is drilled in at the rate of 10 to 20 pounds per acre either in September or March, but best results have been obtained by fall seeding. Cantaloupes are planted in a slight furrow and the vines are trained up on ridges to prevent water from getting on the fruit. The cantaloupes grown on this soil have an exceptionally high flavor and command a premium on the market.

A limited quantity of barnyard manure has been used on this soil, and was followed by excellent results. Some 16 per cent acid phosphate has been used on alfalfa with good results. The alfalfa thus fertilized attained a much brighter green color and better growth than where no phosphate was used.

Land of this phase is said to be held at this time (1922) for $100 to $150 an acre where there is an operating pump plant. In the shallow-water belt west and south of Pecos unimproved land can be bought for around $15 to $25 an acre. For ranching this soil is sometimes sold at about $2 to $10 an acre. All farms on this soil phase are operated by owners. Ranch land leases for 5 to 10 cents an acre.

Since cotton, cantaloupes, and all other crops produce much larger yields when they follow alfalfa, it is natural to assume that more nitrogen and organic matter are needed for maximum production. The application of 200 or 300 pounds of fertilizer containing 10 per cent phosphoric acid and 3 per cent ammonia might give profita-

ble returns. The plowing under of green crops, as cowpeas, rye, sweet clover, or any other green crop, should prove beneficial. It appears that artificial drainage may be necessary on most of this soil, where irrigation is practicable.

REEVES CHALK

Typical Reeves chalk consists of light cream-colored chalky material, composed largely of gypsum, with some hard layers or lenses. In most places there is a surface crust of grayish color about one-sixteenth to one-eighth inch thick. In places the material is hard at the surface; in other places it is soft, with hard material at various depths beneath. The surface hardness probably represents a crusted layer. In places the chalk is soft and cream colored to about 2 feet, where it passes into salmon-colored chalky material, with lenses or particles of harder material. There is practically no organic matter. The content of water-soluble salts does not always run so high as might be expected. The material consists chiefly of gypsum and lime carbonate, and generally effervesces freely with hydrochloric acid, especially in the subsoil. Gravel fragments of quartz and black and reddish rocks, apparently of igneous origin, are found in places.

On cliffs along the northeast and west slopes of Toyah Lake the faintly cemented, whitish or cream-colored material passes below into buff-colored or reddish-brown, granular clay with considerable gypsum, which effervesces freely and tastes salty. There is well-developed columnar structure in the clifflike exposures from the surface down to considerable depths.

The largest areas of Reeves chalk occur north of Toyah Lake and around the headwaters of Fourmile Draw. There are some small bodies along most of the other streams. The surface varies from steep slopes to broadly rolling ridges. The drainage is good.

This type is generally thinly covered with creosote bush, cat's-claw, bear grass, mesquite, and buckthorn. There are numerous small weeds, but grass is practically absent. This soil is used entirely for pasture, and its value for this is low.

VERHALEN GRAVELLY CLAY LOAM

The Verhalen gravelly clay loam consists of about 10 to 12 inches of reddish-brown or chocolate-brown gravelly clay loam, passing into chocolate-brown or light brownish-red clay loam to clay, containing considerable gravel. In many places the soil is a gravelly fine sandy loam and there are hummocks of wind-blown sand about clumps of mesquite. This soil is usually underlain at about 3 feet by whitish conglomerate or "concrete." The gravel, which is present over the surface and through the subsoil, is mostly of igneous origin. The material has been washed from the Davis Mountains.

This type is rather extensively developed adjacent to the Davis Mountains. The largest areas are north and southwest of Saragosa. There are also some areas west and northwest of Balmorhea.

The type usually occurs on gently rolling ridges and lies slightly higher than the surrounding, heavier, gravel-free types. The drainage is good.

The Verhalen gravelly clay loam has rather a thick covering of cat's-claw and screw bean, with a few mesquites. Grass is very scant on the typical soil, but where the gravel is less abundant there is a good growth of tobosa grass. The soil is valued only for pasture land.

VERHALEN LOAMY FINE SAND

The Verhalen loamy fine sand consists of reddish-brown loamy fine sand, often showing a chocolate cast, underlain at about 8 to 10 inches by brownish-red or chocolate brownish-red loamy fine sand to fine sandy loam. Limestone fragments are found in places at depths of about 2 feet. The material effervesces freely with hydrochloric acid, at least in most places. There is usually a slight crust on the surface. The soil material is probably chiefly of igneous-rock origin, apparently having been washed out from the Davis Mountains.

This type is not extensive. The largest area lies at the foot of the limestone escarpment east of Toyah Lake. Several smaller areas occur in other parts of the county. The surface is flattish and very gently sloping, and the drainage is good.

All of the Verhalen loamy fine sand is covered with chaparral, cat's-claw, greasewood, some mesquite, screw bean, bear grass, and Brigham Young weed. There is also a sparse growth of salt grass and needle grass. The vegetation on this type withstands drought better than on the heavier types. If irrigation water ever becomes available, this soil would probably produce fair yields of the general farm crops of this section. At present it is used exclusively for pasture. It is grazed with other types and supports 10 to 15 head of cattle to the section. This land sells for $1 to $2 an acre and leases for $40 to $50 a section.

VERHALEN CLAY

The Verhalen clay typically consists of chocolate-brown clay which passes at depths of 5 to 10 inches into a stiffer and more reddish or reddish-brown clay. In places the lower subsoil is chocolate brown in color. The surface soil takes on a more reddish cast when moist, and some areas have a brownish-red appearance when freshly plowed. In virgin areas the surface may have a crust about one-eighth inch thick, which cracks and curls up at the edges and is pulverized very easily. One mile south of Toyahvale the soil is a brownish-red crumbly clay passing down into brownish-red stiffer clay. Reddish and dark-colored rounded and subangular gravel is present on the surface in places. Thin gravel strata occur locally at variable depths. A bed of gravel 3 to 4 feet thick is usually reached at about 12 feet. The soil is sticky when wet, and cracks rather badly on drying, but pulverizes readily under cultivation. There is usually a decided effervescence with acid, although some areas give only slight effervescence at the surface.

The topography is prevailingly flat, but there is enough slope for good surface drainage. The underdrainage is good owing to the gravel substratum, except where the gravel is " concreted " or formed into a hardpan.

The Verhalen clay occurs in large continuous areas around Saragosa, Toyahvale, and between the Barilla Hills and Saragosa. There are also some areas elsewhere associated with the Reeves soils. The soil was formed of material washed from the igneous rocks of the Davis Mountains and laid down as an outwash plain.

Less than 1 per cent of this soil is under cultivation, the remainder is covered with a thick growth of tobosa grass. Bushes are not found on this type, except where the grass growth has been retarded, as on slightly gravelly areas.

Where this type is farmed under irrigation, from 3 to 5 tons of alfalfa per acre are obtained. Cotton yields one-half to 1 bale per acre. Kafir and milo produce about 30 to 40 bushels per acre. About 90 per cent of the area in cultivation is used for alfalfa. The best results have been obtained by flat-breaking the land and watering in the rough, then working it down to fine condition and drilling alfalfa about September 15 to October 1. Cotton is planted in a furrow 3 or 4 inches deep. The better farmers use a slope of 0.1 foot per hundred and checks 400 to 600 feet long. The alfalfa and cotton are sold as cash crops. With increased water-storage facilities for irrigation, much of this soil could be put under cultivation. One of the best methods of improving the soil probably would be to plow in green-manure crops.

Improved land of the Verhalen clay was held, at the time of the survey, for about $100 to $150 an acre, with water rights. The dry (unirrigated) land was held for $5 to $15 an acre.

Some areas of Verhalen stony clay have been included with the Verhalen clay. These differ from the clay chiefly in the presence of an abundance of stone on the surface and through the soil. The stones are well-rounded igneous rocks of reddish and rusty-brown color, varying in size from a few inches in diameter to small bowlders. This stony soil occurs only adjacent to the Davis Mountains, where it occupies flats, slopes, and slight ridges.

The Verhalen stony clay has a good covering of tobosa grass, some bird of paradise, screw bean, algerita, and cat's-claw. In places century plants, Spanish dagger, and bear grass are abundant. This land is used for pasture. It affords fairly good grazing and supports 15 to 20 head of cattle to the section.

ECTOR GRAVELLY LOAM

The Ector gravelly loam consists of light-brown or yellowish-brown gravelly loam or gravelly silty clay loam, grading at a depth of 6 or 8 inches into cream-colored to light-buff or light yellowish-brown gravelly silty clay loam which extends to depths of 36 inches or more. Fragments of limestone, generally not over 5 or 6 inches in diameter, are strewn over the surface and are disseminated throughout the soil and subsoil. The material effervesces freely with hydrochloric acid. In place the material is compact or hard, but loosened fragments crush easily. This soil is derived from the limestone of the Edwards Plateau. Some included areas represent Ector stony loam.

The Ector gravelly loam is not extensive. The largest areas occur in the Barilla Hills and in the southwestern and northwestern

parts of the county. The topography varies from comparatively smooth to steeply sloping. The drainage is good.

This entire type is covered with native vegetation of sumac, ocotillo, Spanish dagger, juniper, screw bean, mesquite, and broomweed. There is a sparse growth of a small tough grass. This land is used for pasture and supports about 5 to 10 head of cattle to the section. It is valued at and leased for about the same price as the Reeves gravelly soils.

BALMORHEA CLAY

The typical Balmorhea clay consists of black clay, rich in organic matter, underlain at about 15 inches by greenish-yellow, yellowish-brown, or grayish, soft, chalky, calcareous material. In a few patches the black clay extends to depths of 36 inches or more. The chalky calcareous material is exposed at the surface in places and frequently is encountered within 6 inches of the surface. In some of the depressions the high content of organic matter imparts a condition approaching a muck soil. The material pulverizes by cracking on drying, giving rise to a good tilth. The content of lime carbonate is high. The type was developed under moist conditions.

In some areas the surface soil varies in texture to clay loam, silty clay loam, or loam. Just west of Brogado the soil is a very dark brown clay loam to silty clay loam, passing at 10 inches into dark-brown clay, which becomes lighter in color with depth and passes at about 26 inches into yellowish-brown sandy loam. Another boring near by showed black loam passing at 8 inches into black clay, which grades through brown into yellowish-brown clay, containing some whitish material. In another locality the black clay contains whitish granular material at 15 inches. This granular material has a high content of lime carbonate and it probably hardens on drying, similarly to the hard, light-colored lining seen in irrigation ditches.

Only three areas of this type were mapped. One lies south of Pecos on Toyah Creek, another about 3 miles southeast of Saragosa, and the third extends from north of Brogado to about 3 miles south of Balmorhea.

The surface is flat and the drainage is sufficiently well established for successful crop production.

The two areas in the Balmorhea district are entirely in cultivation. The area south of Pecos is covered with salt grass and mesquite bushes and is used for pasture. Alfalfa was the only crop seen on this type, except for a small pear orchard. Most of the alfalfa is sold, a small part being consumed by work stock and the home dairy cattle. Some has been grown for the seed. The yields range from 3 to 6 tons of hay per acre, according to local estimate, or 300 to 800 pounds of seed. Land for alfalfa is prepared in the same manner as on the other level clay soils. It is reported that an application of about 200 pounds of acid phosphate per acre has given better yields.

This land was selling for about $175 to $250 an acre in the improved state (ready for irrigation), with water rights, at the time the survey was made. The undeveloped soil at that time was held around $5 or $10 an acre.

TOYAH FINE SANDY LOAM

The Toyah fine sandy loam consists of brown fine sandy loam or loamy fine sand, grading at about 6 inches into light-brown or yellowish-brown fine sandy loam, which passes at about 15 inches into brown or yellowish-brown friable loam or clay loam, locally containing friable whitish material on the order of incipient caliche. In places the lower subsoil is a dark-colored clay loam. In depressed areas gray and rusty-brown mottlings are present in the lower part of the 3-foot section. In some places brown or grayish-brown fine sands extend to a depth of 36 inches or more; on these there is some wind drifting, forming small sand dunes around clumps of vegetation.

The Toyah fine sandy loam is confined to the first bottoms of streams. It occurs principally along Toyah Creek. There are some narrow strips along several of the smaller streams, particularly Fourmile Draw and Salt Creek.

The surface of this type is flat, with some local billows due to wind-drifted sand. The drainage is good to excessive. In places there is a hardpan which prevents efficient underdrainage.

This type is not important agriculturally, only about 20 per cent being under cultivation. The rest is covered with salt grass, tobosa grass, and mesquite and is used for pasture. Alfalfa is the important crop. Cotton occupies a small acreage. Both of these are shipped out as cash crops. Alfalfa yields about 5 tons from six cuttings. Cotton yields one-fourth to 1 bale per acre. This soil is handled the same as other Toyah soils, except that a greater slope is given to the checks for irrigation on this type, the slope being 0.2 foot to 0.3 foot per hundred feet.

Land of this type was held at the time of the survey for prices ranging from about $100 to $150 an acre, depending upon location and improvements. The dry unimproved land was held for about $2 to $5 an acre, along with other included soils.

Organic matter seems to be the greatest need of this soil. The plowing under of green crops or the application of manure should give increased returns. This is an ideal vegetable soil, but ample water must be available for timely irrigation.

There are some included areas of Toyah gravelly fine sandy loam consisting of grayish or brown, very gravelly (and cobbly) fine sandy loam to fine sand, which show practically no change to a depth of 3 feet or more. There is some stream-bed material (river-wash) where the channel spreads out to a width of 200 feet or more. This soil occurs only in small areas along Toyah Creek. The drainage is good to excessive. This soil is used for pasture. The better parts support a growth of tobosa grass, salt grass, and some "desert willow," mesquite and cat's-claw.

TOYAH LOAM

The Toyah loam is a brown mellow loam, passing at about 10 to 14 inches into brown friable loam or clay loam. In some places yellow material resembling limonite is present in the lower subsoil, and in other places there is whitish caliche. Locally the upper subsoil consists of clay loam or clay, and the lower subsoil of brownish to

whitish friable material. Both soil and subsoil effervesce freely with hydrochloric acid. Some included areas have a lower subsoil of yellowish-brown to grayish-brown fine sandy loam or fine sandy clay. In places there is practically no change in color or texture to a depth of 24 to 30 inches.

This soil has a good supply of organic matter, is retentive of moisture, absorbs water easily, and has an excellent tilth under cultivation. According to well reports, a gravel stratum underlies this type at depths of 4 to 12 feet.

The Toyah loam is a first-bottom or recent-alluvial soil. With the exception of a few small areas along the smaller creeks, it is confined principally to the Toyah Creek bottoms. Its largest development is in the vicinity of Balmorhea and Saragosa. The surface is flat, with enough slope to promote good surface drainage. The underdrainage is also well established where the gravel stratum is encountered.

About 90 per cent of the type is under cultivation. The remainder is covered with tobosa grass, with a little salt grass in places. This type is used principally for the production of alfalfa. A small acreage is devoted to cotton, wheat, and corn. Dairying is developed on a very small scale. All alfalfa except that consumed by work stock and dairy cows is shipped to east Texas points. Cotton and wheat are also cash crops. The corn is used on the farm. Farmers report 20 to 40 bushels of corn per acre, one-half to 1 bale of cotton, 20 to 40 bushels of wheat, and 3 to 6 tons of alfalfa per acre. Oats have yielded 40 to 60 bushels per acre.

The Toyah loam is usually kept in alfalfa from 10 to 20 years, the length of time depending largely on the condition of the field. Where the field has become foul with grasses and weeds it is usually plowed in the fall and seeded to wheat about October 10 to 20. The wheat is harvested about June 1 to 15, and the field is plowed about every 15 to 20 days to kill out weeds and grasses. The field is then prepared and seeded to alfalfa about September 15 to October 1. Sometimes Mexican June corn follows wheat. As a rule cotton follows alfalfa for one year, and the field is reseeded to alfalfa in the spring. Oats are seeded as a rule in February and harvested about May 15. Alfalfa receives water every 30 days, about 4 inches at a watering, commencing about February 15 or March 1. Wheat receives about four to six applications of water from time of seeding until harvest. A few fields of alfalfa have received 200 pounds of 16 per cent acid phosphate, which appears to have given profitable returns.

This type of soil, with water rights and improvements, was selling at the time of the survey for about $125 to $175 an acre. The dry, unimproved land was selling for $2 to $15 an acre, with other types included. For pasture this land has about the same value as the Verhalen clay.

The general practice of the farmers on this soil is to sell all alfalfa except a small quantity consumed by the work stock and a cow or two. It would seem advisible to keep enough cattle, either dairy or fat stock, on the farms to consume the alfalfa and return the manure to the land. Cornstalks grow very large, and it is possible that 200 or 300 pounds of acid phosphate would greatly increase the

yields of cotton, corn, and wheat. The soil has a good supply of organic matter, and the plowing under of green crops may be a good practice for maintaining the supply. Vegetables, cantaloupes, and similar crops could be grown with an adequate supply of water.

TOYAH SILTY CLAY LOAM

The Toyah silty clay loam is a dark-brown to brown silty clay loam, passing at a depth of 8 or 10 inches into dark-brown or chocolate-brown silty clay loam or silty clay, which extends to 3 feet or more. The soil is friable and easy to cultivate, forming a good tilth. It effervesces freely with hydrochloric acid. The areas outside the Toyah Creek Valley are of a good brown color, with very little change in the profile. Some spots show pale-yellow and rusty-brown mottlings in the lower part of the 3-foot section.

This is a first-bottom soil. It is subject to overflow in all places except the Balmorhea and Saragosa districts, where the overflow is largely prevented by a flood-water diversion dam constructed in the Toyah Creek channel. This is the most widely distributed alluvial soil in the county, as it occurs along all the creeks of the area. Its largest development is southwest and west of Saragosa and in the vicinity of Balmorhea.

The surface is prevailingly flat, with enough slope to insure sufficient surface drainage. The underdrainage is good except in small local areas.

About 30 per cent of the Toyah silty clay loam is under cultivation. The remainder supports a good growth of tobosa grass and salt grass, with bushes of mesquite and cat's-claw. The mesquite attains a greater height on this type than on other soils.

The important crop is alfalfa; this occupies about 90 or 95 per cent of the cultivated area (Pl. XXX, fig. 2). A small acreage is devoted to wheat, corn, and cotton. Dairying is carried on in a very small way. This is one of the most productive soils of the Toyah Valley. Alfalfa yields 3 to 6 tons per acre, according to local estimates, cotton from one-half to 1 bale per acre, wheat 30 to 40 bushels, corn from 25 to 50 bushels, oats 40 to 70 bushels.

No rotation is practiced. Alfalfa is usually seeded in a well-prepared seed bed from about the middle of September to the first of October. Stands hold for 10 years or more, it is reported. When an alfalfa field is plowed up it is usually seeded to wheat in the fall. After the wheat harvest the land is plowed and planted to corn or merely plowed several times to kill the weeds and reseeded to alfalfa. Wheat is pastured during the winter, which keeps it from jointing too early. Alfalfa is sometimes pastured during the winter, but this is considered poor practice. Where oats follow alfalfa the land is usually flat-broken 6 or 7 inches deep, the seed being drilled in after the ground has been pulverized and watered. Cotton is planted in a shallow furrow about April 15 to May 1. Where row crops are grown they receive some shallow level cultivation.

This land, with water rights and in an improved state, was selling at the time of the survey for $150 to $225 an acre; and unimproved dry land for $2 to $5 an acre, including usually some adjoining types.

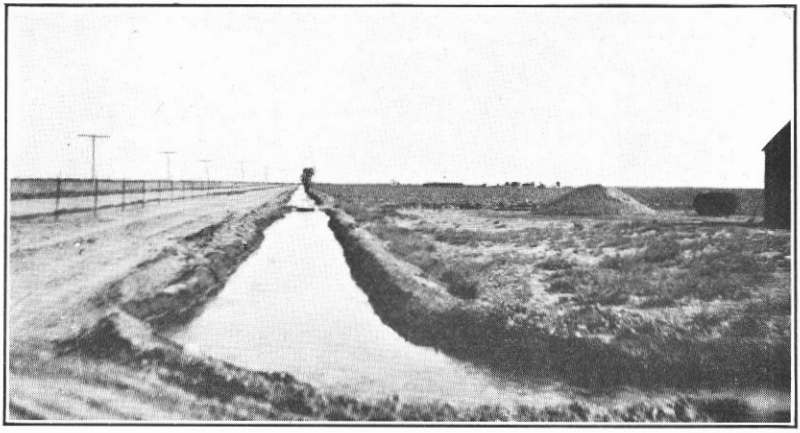

FIG. 1.—VIEW ON AN AREA OF REEVES SILTY CLAY LOAM, DEEP PHASE, SHOWING FLAT TOPOGRAPHY AND IRRIGATION CANAL

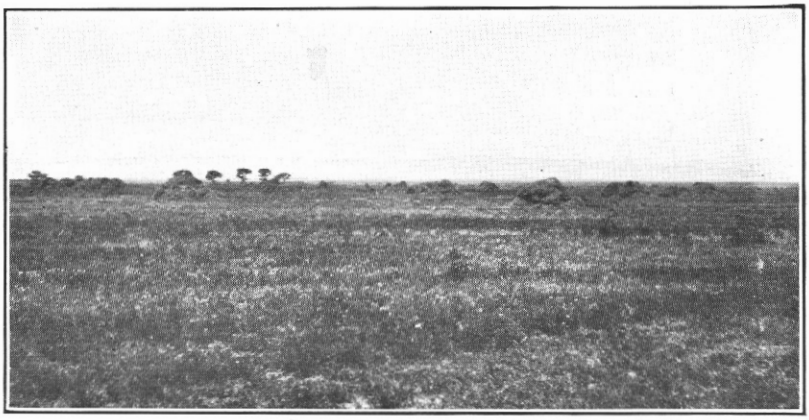

FIG. 2.—ALFALFA ON TOYAH SILTY CLAY LOAM

ARNO VERY FINE SANDY LOAM

The typical Arno very fine sandy loam consists of about 10 to 15 inches of light chocolate-red very fine sand or loamy very fine sand, overlying chocolate-red clay, which extends to depths of 36 inches or more. When dry the immediate surface soil has a decidedly grayish cast. Both soil and subsoil are calcareous. The soil is friable; the subsoil is stiff and plastic when wet, but crumbles when exposed to drying. There are included patches of very fine sand 3 feet or more in depth; also some patches consisting of 20 to 30 inches of light chocolate-red loamy fine sand underlain by chocolate-red silty clay or clay. In places thin seams of very fine sand or fine sand are interbedded with the clay subsoil.

The soil is drifted by wind in places, giving rise to a billowy or hummocky surface, as one-half mile east of Independent Dam. One-half mile north of Patrole the soil is a chocolate-red or light chocolate-red very fine sandy loam, grading at about 20 to 24 inches into salmon-colored to pale-yellow sand. Locally the type ranges in texture to fine sandy loam, as in the section north of Patrole. The fine sandy loam here consists of light chocolate-red fine sandy loam to loamy fine sand, grading at about 15 to 20 inches into salmon-colored loamy fine sand and at about 20 inches into salmon-colored fine sandy loam, underlain by chocolate-red to dark chocolate-red silty clay.

The Arno very fine sandy loam is found only in the Pecos River bottoms. The principal area lies immediately north of Patrole. A narrow strip borders the Pecos River from north of Riverton to the eastern county line, except for a few interruptions where Arno clay borders the river.

The surface varies from flat to billowy or hummocky, with a gradual slope toward the river. The surface drainage is good, but the underdrainage is deficient owing to the impervious clay. Following irrigation the water table rises in places to 3½ or 4 feet from the surface.

Probably not more than 5 per cent of the type is under cultivation. The remainder is covered with a good growth of salt grass, salt cedar, broad-leafed sage, and mesquite trees (or bushes), and is used for pasturing cattle. The farmed land is devoted entirely to the production of cotton. The average yield ranges from a fraction of a bale to 1½ bales per acre, depending on local alkali and drainage conditions.

The type is handled in essentially the same manner as the other irrigated alluvial soils, except that the water is usually applied after seeding instead of before. This is done because the sandy soil does not crust over to prevent plants coming up properly. The slope can be as much as 0.4 of a foot per hundred feet, according to experience, as the soil takes up water rapidly and liberally.

Improved land, with water rights, was selling at the time of the survey, for about $50 to $100 an acre, and the unimproved land for about $10 to $30 an acre.

The principal needs of this soil, in so far as the field investigations indicated, are drainage and flooding to reduce the alkali content.

The plowing under of green crops would probably be beneficial, and light applications of nitrogenous fertilizers might be profitable.

ARNO CLAY

The surface soil of the typical Arno clay is a chocolate-red to dark chocolate-red clay, which passes at depths of about 20 to 40 inches into lighter-colored and lighter-textured material—in many places salmon-colored fine sandy loam, sandy clay loam, loamy fine sand or even fine sand. In places dark chocolate-red clay passes at about 10 or 15 inches into lighter-colored clay. Some included patchy areas consist of silty clay overlying very fine sand or fine sand. The material is high in content of lime carbonate. The soil is very plastic and sticky when wet, and cracks on drying. In all tests made for alkali the content ran too high for production of the economic crops grown in the region.

The Arno clay and Arno very fine sandy loam are the predominating soils of the Pecos River flood plain. The largest areas of the clay type occur north of Arno. There is considerable of the clay east of Pecos, and smaller areas occur elsewhere through the bottoms. The surface is flat and subject to overflow at times, and the drainage is poor.

This type is used exclusively for pasture. There is a good growth of salt grass, mesquite, and broad-leafed gray sage, and some narrow-leafed sage. Salt cedars are abundant near the river.

The Miller and Yahola clays, found in the bottom of streams flowing through and issuing from the Red Beds regions of western Texas and Oklahoma, are almost identical with the Arno clay in all respects save that of excessive content of water-soluble salts; and those types are highly productive. It can be safely concluded that the Arno clay would also be highly productive, provided the salts were removed. Probably this harmful surplus of salts could be economically reduced by repeated flooding, after close ditching (or tiling) to provide for removal of the percolating water, at least to the extent of making it possible to grow fair crops. Experience in near-by irrigated districts indicates probable good results from ditches about 6 to 8 feet deep and about 200 to 300 feet apart. During the irrigation season the water table in this soil usually stands within about 4 feet of the surface, at least in many places.

PECOS SILTY CLAY LOAM

The Pecos silty clay loam is a dark-gray or grayish-brown silty clay loam, grading at about 10 to 15 inches into dark-gray or olive-brown clay, which extends to 30 inches or more. Chocolate-red clay is encountered in many places at about 30 inches. The soil is sticky and plastic when wet but crumbles on drying. The entire area mapped as Pecos silty clay loam has a distinct light chocolate-red surface cast at a distance, when dry.

Some areas consist of grayish-brown silty clay loam passing into chocolate-red clay at about 10 inches, this extending to depths of 3 feet or more. Streaks of fine sand and very fine sand, and some flakes or crystals of gypsum were noted locally in the subsoil. About 5 miles north of Pecos the soil is ashy-brown to dark ashy-brown

clay, grading at about 8 inches into olive-brown clay containing a little whitish gypsum and some olive-drab and grayish-brown and reddish mottling in the lower subsoil, with chocolate-red clay at 40 inches.

This type is not extensive. It occurs only in the Pecos River bottoms, the largest areas being those near the Sullivan Bridge. Smaller areas lie south and southeast of Dubose School.

The Pecos silty clay loam occupies a slightly higher position than the adjacent soils. The surface is flat, but owing to the slight elevation, the drainage is better than on the Pecos and Arno clays.

Probably 90 per cent of the type is under cultivation. The remainder is covered with salt grass, small mesquite trees (or bushes) and narrow-leafed sage, and is used for pasture.

Cotton and alfalfa are the only crops grown, about an equal acreage being devoted to each. Cotton yields from one-half to 1 bale per acre, and alfalfa from 3 to 5 tons, according to local estimates. Cotton is said to have made as much as 2 bales per acre and alfalfa as much as 6 or 7 tons per acre. This soil is handled the same as the Pecos clay. Improved land, with water rights, was held at about $75 to $100 an acre at the time the survey was made.

The alkali content, as indicated by the tests made, does not average so high as in the Pecos clay, but in the places examined it was still too high for maximum production. A good stand of alfalfa is easier to obtain than on the Pecos clay. Drainage by ditching and subsequent flooding should prove beneficial.

PECOS CLAY

The soil of the typical Pecos clay is a dark-gray or grayish-brown clay which dries to an ashy cast. This is underlain at about 20 to 24 inches by chocolate-red clay extending to depths of 3 feet or more. The soil is very sticky and plastic when wet, but crumbles on drying. There are streaks of gypsum crystals in both the soil and subsoil, at least locally. The soil and subsoil contain sufficient lime to effervesce freely with hydrochloric acid.

Some areas consist of dark-brown clay, passing into olive-brown plastic clay, and into chocolate-red clay at 30 inches, as 1 mile north of Pecos. There are also patches of dark-gray to nearly black clay, with chocolate-red clay coming in beneath. About 3 miles north of Pecos the soil is nearly black to dark ashy gray, with an ashy cast at the dry surface; this passes at about 1 foot into yellowish clay, becoming whitish with depth, underlain at about 20 to 30 inches by chocolate-red very fine sandy loam, fine sandy loam or fine sandy clay loam. South of Patrole there is a veneer of chocolate-red clay over dark-gray clay, representing a recent deposit of alluvium.

The Pecos clay is confined to the Pecos River bottoms. The largest area is north of Pecos.

The surface is flat and the drainage poor. The water table varies between depths of about 3 to 5 feet beneath the surface. The land is subject to overflow from the river, and each inundation deposits additional sediments which enrich the soil.

The type is used almost exclusively for pasture. A large proportion of it is covered with salt grass and mesquite trees (or bushes)

and narrow-leafed sage. Only patches are cultivated; these are used for cotton and alfalfa, chiefly the former. It is said to be difficult to get good stands of crops on account of alkali. Cotton yields from a fraction of a bale to about three-fourths bale per acre, and alfalfa from 1 to 3 tons.

In handling this soil, experience indicates that it is best to plow, then water, disk, and prepare a fine seed bed before planting. It is said to be practically impossible to get a satisfactory stand of crops if water is applied between the time of planting and the coming up of the plants. If a shower follows seeding, before the plants are up, the most successful farmers break the crust with a spike-tooth harrow or other implement.

This type of soil was selling for about $50 to $75 an acre in the improved condition, with water rights, at the time the survey was made. Unimproved soil was valued at about $10 to $25 an acre.

Most of the farms on this type have been abandoned owing to unfavorable alkali conditions brought about probably by the rise of the water-soluble salts under conditions of inadequate provision for drainage, and the removal of the excess percolating water, such as accumulates and causes "subbing." Where alkali is injurious the soil should be efficiently ditched and then flooded to wash out the salts. By thus reducing the excess of alkali, fair to good yields of cotton and alfalfa should be obtained. The tests made indicate that much or most of the type contains enough salts to interfere with good crop production.

PATROLE SILTY CLAY LOAM

The Patrole silty clay loam is an ashy-gray silty clay loam to a depth of 8 to 10 inches, passing into light-gray silty clay loam mottled with yellow and rusty brown, and extending to a depth of about 18 to 24 inches, where chocolate-red, stiff clay is encountered. Gypsum crystals or flakes are present from the surface down. The material effervesces freely with hydrochloric acid. The soil is sticky when wet but crumbles when dry, assuming a rather powdery structure. A veneer of about one-half to 1 inch of chocolate-red silty clay loam is found in some places; this represents alluvial material of comparatively recent deposition. Locally the subsurface horizon is bluish to greenish gray in color and chalky in character, with much gypsum.

The type occurs only in the Pecos River flood plain, and is confined chiefly to a rather narrow continuous strip extending from about 1½ miles north of Pecos to about 8 miles north of Pecos. There is another area of some size at Patrole. The type occupies a slightly higher position than the adjacent soils. The drainage is poor because of the flat surface and rather impervious clay subsoil.

This type of soil is used exclusively for pasture. It has a good covering of salt grass and mesquite bushes, with some narrow-leafed sage. It could be bought for about $10 to $20 an acre at the time of the survey.

It is said that some of this soil produces fair yields of cotton for a year or two. Owing to its high alkali content it probably is not advisable to farm it until the better soils are made use of, as the soil is recognized as inferior.

ROUGH STONY LAND

Rough stony lands consists of areas which are too rough and too stony for farming. Extreme stoniness is its most outstanding feature. It varies from very steep and rugged, mountainous stony land to gently sloping and rolling stony land. The soil material is of very shallow depth; in many places bare rocks and cliffike rocky escarpments prevail. Loose surface rock is abundant. On the more moderate slopes the soil material is deeper, merging into soils similar to the Verhalen and Ector. The soil of igneous-rock origin consists of reddish-brown clay or clay loam; that from limestone is prevailingly light-brown or grayish-brown silty clay loam.

The area of Rough stony land is not very extensive. Its greatest development is the Davis Mountains, Barilla Hills, and the hills in the vicinity of San Martine. It is confined entirely to the extreme southern part of the county. A number of small isolated hill areas stand out prominently in the outwash-plain region.

The drainage is excessive. In most places the soil material has been washed away nearly as rapidly as it has been formed.

Land of this kind supports a good growth of grama grass, small juniper trees, Spanish dagger, bear grass, several varieties of cactus, and some sumac. Local opinion classes the mountainous country as the best grazing land of the region. Showers are frequent in the mountains during the summer season of some years.

This type of land is held in large ranches ranging in size from several thousand to 200,000 or 300,000 acres. At the time the survey was made it was valued at $3 to $4 an acre.

IRRIGATION

The rainfall in Reeves County is insufficient for the production of economic crops. Dry farming on a small scale has been tried, usually with unsuccessful results. Some years there is sufficient rainfall to grow crops, but these years are of uncertain and infrequent occurence, so that it is not safe to undertake any sort of farming operations without provision for irrigation water.

Irrigation in Reeves County has kept pace with the available water supply. It has been estimated that about 15,000 acres are in cultivation in the Toyah Valley district; about 3,000 acres in the Pecos River bottoms, all north of the town of Pecos; and about 1,000 acres south and west of Pecos on the uplands.

The main supply of water is obtained by gravity from the Pecos River and Toyah Creek. This is supplemented with water from Head Spring and Phantom Lake. A reservoir east of Balmorhea supplies about 1,000 acres. A dam constructed in Toyah Creek diverts the flood waters from the headwaters of Toyah Creek into this reservoir. The supply from Head Spring, about 40 second-feet, is also turned into the reservoir during the winter months. The water from the Pecos River is also diverted by a dam. There were no storage dams along the river at the time the survey was being made. The Red Bluff project is reported to contemplate the construction of an immense dam across the Pecos River a few miles north of the Texas-New Mexico State line. In the vicinity of Pecos artesian

water is used for irrigation on a small scale. West and south of Pecos there is a shallow-water belt, where irrigation water is made available by pumping systems. These wells are from 200 to 500 feet in depth, and the water rises to within about 20 to 75 feet of the surface. This pumped water seems to be sufficient for the area under cultivation. There is more land under cultivation dependent on the gravity supply system than can be watered properly in a droughty year.

Water is conveyed to farms by open ditches, and there is considerable loss from seepage. The gypsum soils are very undesirable for open-ditch distribution, as the loss by seepage has been estimated to be as much as 60 per cent. Small openings (probably of the "sink hole" type) are common in the gypsum beds, and these contribute to the loss.

The check method of irrigation prevails; a few farmers use the furrow method for row crops. The deep alluvial soils retain moisture best and require less water than those with porous subsoils. The length of the irrigating season and the number of applications given varies somewhat and depends largely upon the amount and distribution of rainfall. Alfalfa under the gravity system receives its first water about February 15 to March 1, and subsequently one application for each cutting. The pump irrigation projects apply water twice for each cutting. Cotton receives about three or four waterings. Cantaloupes and watermelons are watered every 6 to 10 days. Wheat usually receives six waterings from the time it is seeded until harvest.

The cost of water varies and depends upon the distance from the source of supply, and, in the case of pumped water, the height of lifting from the wells. Water from gravity sources ranged in cost from $4 to $6 per acre at the time the survey was made. Pumped water cost from $2.25 per acre to $20 per acre, depending on the lift, the kind of engine and pump, and the man operating the machinery. The gravity water is supplied to users by companies, the users being stockholders and sharing proportionally in the costs. In the pumping section each farmer has his own well.

The common engine for the pumping plants was the 25-horsepower Bessemer, oil-burning type, and the pump was type Q. Some failures are said to be due to inefficiency of the engine and poor installation—chiefly failure to place the pump in the well so that the intake is always submerged. These pump wells were yielding from 800 to 2,000 gallons per minute. One outfit had a capacity for irrigating up to 120 acres.

The advantage of the pump system over the gravity or company-owned system is that the farmer can get water when it is needed and can grow crops of different water requirements. Under the gravity system water was supplied every 25 to 32 days at the time of the survey.

Irrigation under the gravity systems could be greatly extended if the sites for storing water were utilized and the flood waters stored. There are numerous sites in the Davis Mountains that can be developed. There are also a number of possible sites along the Pecos River.

ALKALI

The term "alkali," as commonly used in arid and semiarid regions, refers to excessive accumulations of water-soluble mineral salts. The principal substances composing alkali are the chlorides, sulphates, and carbonates of sodium, magnesium, and calcium, or a mixture of two or more of these salts. Other substances may be present, but they are relatively unimportant. Alkali is commonly spoken of as "white alkali" and "black alkali," depending somewhat on the appearance of the incrustations caused by excessive accumulations on the surface. Usually when large quantities of sodium sulphate or sodium chloride (common salt) accumulate on the surface their presence is marked by a white incrustation; hence the term in common use, white alkali. Since sodium carbonate, where present in considerable quantities, corrodes the vegetable matter of the soil, forming a brown or dark stain, it is called black alkali. As calcium chloride, a much less toxic salt, may likewise impart a dark stain to the soil, it is evident that this classification is not altogether satisfactory.

During the process of soil formation quantities of soluble salts are set free by the chemical changes incidental to rock weathering. In regions of abundant rainfall these soluble salts are largely leached out of the soil and washed away, but in regions of limited rainfall most of these salts remain in the soil. As a general rule, more or less alkali is present in regions having a rainfall of less than 20 inches, whereas in regions with rainfall of more than 20 inches the tendency for such accumulation is materially lessened.

The water-soluble salts composing white alkali remain stationary in a dry soil, but when water is added they are dissolved and move within the soil with the water. Places heavily incrusted with alkali show no such crusts after heavy rains or the application of irrigation water, because the alkali is dissolved and carried into the soil, but as the soil dries out it appears again on the surface. This is because much of the water added returns through capillarity to the surface, where it evaporates and leaves all of the dissolved salts as a deposit on and near the surface. Many farmers have found that after few years of irrigation alkali has appeared where its presence was not suspected. In such cases the appearance of alkali is due to a number of causes. One such cause is the dissolving of the deep-seated stores of salts by irrigation water penetrating to the deep subsoil, with subsequent upward movement of the dissolved salts and their concentration near the surface. Some areas contain alkali in toxic amounts because of seepage accumulation, where there is no adequate outlet for removal of the water seeping into the soil from higher-lying irrigated areas or lower irrigation ditches. Others reach the same condition because there is no provision for taking away surplus irrigation water.

At least a trace of alkali was found in all the soils tested in Reeves County. Since the concentration of alkali in the various soils varies so much, it was impossible or impracticable to map the alkali areas satisfactorily; however, the percentage of alkali found in the different tests is indicated on the map.

The most uniform concentration occurred in the Arno clay and the shallow variation of the Reeves silty clay loam. In the tests

made on the Arno clay the average content of water-soluble salts for the 6-foot vertical section ranged from 1.5 to over 3 per cent. On the shallow variation of the Reeves silty clay loam the corresponding range was between 1 and 5 per cent. As high as 1.5 per cent and as low as 0.6 per cent was found in the Pecos clay and Patrole silty clay loam. In spots of the deep phase of Reeves silty clay loam as high as 1.5 per cent was detected. In the Balmorhea district there are only very localized areas in which the salt accumulation is too great for good production. The greatest concentrations of alkali were found in the heavy-textured, low-lying, poorly drained soils.

Sodium chloride (common salt) is the principal alkali salt. No black alkali was found in the field tests made. Chemical analyses of dark spots, which were considered locally to be due to black alkali, showed a high concentration of calcium chloride as well as sodium chloride. Some magnesium-calcium nitrate was also found in one sample of a dark spot from the site of the old experiment station. Sodium chloride is the principal salt in the river and artesian water; calcium suphate ranks next, then magnesium sulphate, with a small percentage of magnesium chloride and calcium carbonate.

The general run of artesian water in the Pecos Valley tested 0.19 per cent of total soluble salts. The water used for irrigation from wells in the pumping district tested from 0.19 per cent to 0.51 per cent of the total salt. The spring water at Balmorhea tested 0.23 per cent of total soluble salts. The Pecos River concentration depends upon rainfall. In April and May of 1921 the flow in the Pecos River was evidently largely seep water from the Roswell and Carlsbad irrigation districts. In April the river water tested 0.57 per cent total salts and in May it had increased to 0.75 per cent. The water in the Barstow district drain ditches tested about the same as the Pecos River. This high salt content was due to the fact that there had been no appreciable rainfall since August of the preceding year. If rainfall had not come in July, the Pecos River water would have been so highly concentrated that its use on crops would have been detrimental. This has happened a number of years along the Pecos River where storage facilities are not maintained. The concentration of salts increases down the river. The United States Department of Agriculture Report No. 64 (1900) reports the soluble salts in Pecos River water at Carlsbad, N. Mex., as 240 parts per 100,000 and at the bridge east of Pecos as 525 parts per 100,000. This shows the relative increase.

When any considerable quantity of alkali is present in soils it exerts a toxic influence on the crops. Not all plants are affected alike; some plants can withstand quantities of alkali that would be fatal to others; also, the various kinds of alkali salts are not equally injurious to the different crops. Among the more resistant cultivated plants are certain varieties of barley, sorghum, and sugar beets; corn, wheat, and cotton are examples of the more sensitive crops. Alfalfa in its younger stages is sensitive to alkali, but when once well established it becomes very resistant. Practically all economic plants are sensitive to alkali during the germination period and early plant growth.

Sodium carbonate (black alkali) is considered the most injurious, magnesium chloride and sulphate next, and then sodium chloride.

About 0.05 per cent of sodium carbonate, 0.5 per cent of sodium chloride, and 1 per cent of sodium sulphate are considered the endurance limits of most crops. In the field tests cotton showed the effects of 0.45 per cent of total salts and no effect where the salt content was less than 0.2 per cent. Where the alkali content was 0.75 per cent the alfalfa plants were very scattered and made practically no growth. The tests indicate that maximum production can be maintained when the total salt content is below 0.2 per cent and that there is practically no production with a content between 0.5 and 0.75 per cent. In some places spotted fields may be caused by a high water table with low salt concentration, and in others the poor stand may be almost entirely due to alkali.

Where alkali concentrations have become so great that crops can not be produced after a few years of irrigation, methods for reclaiming the land may be resorted to, but this should not be done if the value of the land after being reclaimed is less than the cost of reclaiming it.

The only effective method known at present for reclaiming white-alkali land is by artificial drainage and flooding to leach out the excess of salts. If good natural underdrainage exists, reclamation by flooding should be feasible. Very few irrigation districts have proved successful until a drainage system was installed. On the other hand, a large number of abandoned areas have been completely reclaimed by draining and flooding. The irrigation district at Barstow, 7 miles east of Pecos, was a failure until a drainage system was installed. All the bottom land on the Pecos side of the river has been abandoned except that having the best natural drainage by reason of position and pervious substrata. In a few places in the Barstow drainage district the drains are ineffective because of a hardpan layer. On the whole, the drainage system installed at Barstow is successful, although more ditches would improve conditions. The distance that water will percolate to a drain depends on the character of the soil and subsoil. A sandy soil will not require drain ditches so close as a clay soil. For the most widespread and effective results a drainage system should be installed by the district in the same manner as the irrigation-water system is maintained. Drain ditches for alkali reclamation probably should be about 6 to 8 feet deep. In case an extensive hardpan is encountered at less than 4 feet from the surface it is possible that reclamation would not be feasible.

The accumulation of excessive salts on the surface may be prevented or retarded by shallow and frequent cultivation, mulching with straw, or the application of water frequently. Any method that lessens evaporation will tend to lessen surface accumulation of salts. But these methods are not successful where there is a high concentration in the lower subsoil. The prevention of excessive surface accumulation is especially desirable during the germination stage.

It is believed that practically all the soils in the Pecos bottoms could be reclaimed profitably, with the possible exception of the Patrole silty clay loam. A drainage system is now (1922) being installed on the Arno very fine sandy loam and Arno clay north of Patrole.

SUMMARY

Reeves County lies in southwestern Texas, along the New Mexico State line. It has an area of 2,596 square miles, or 1,661,440 acres.

The greater part is a flat to undulating plain; the southern part is mountainous, and there are some hilly areas. The elevation ranges from about 2,400 to 5,000 feet above sea level. The average elevation of the plain area, which covers more than 75 per cent of the county, is about 2,800 feet, and the mountainous area in the extreme southern part of the county varies from 3,000 to 5,000 feet above sea level. The general slope is to the east and southeast. Regional drainage is fairly well established. All the county is drained by the Pecos River and its tributaries.

The population of Reeves County in 1920 was 4,457. It was all classed as rural, but probably 90 per cent of the people live in small towns. The Toyah Valley and the Pecos River Valley are the most thickly populated farming sections. The remainder of the county is occupied by ranchmen.

The county has good railroad facilities. The principal markets for agricultural products are eastern Texas and some northern markets.

The winters are rather short and mild, with a mean temperature of 47° F. for December, January, and February. The summers are long and moderately hot, the mean temperature for the three summer months being 81.5° F. The average growing season is 218 days. The average annual precipitation is about 11 inches, of which more than half usually falls during July to October.

The greater part of the county is used as pasture land for beef cattle. Farm crops are grown only where water is available for irrigation. Alfalfa and cotton are the important crops, the acreage being about the same for each. Wheat, corn, kafir, cantaloupes, and watermelons are minor crops. Very few dairy cattle are kept. Poultry is found on most farms. Farm labor is generally plentiful.

The price of good farm land in 1922 (when this survey was made) ranged from about $75 to $250 an acre. Ranch or pasture land sold for about $1 to $30 an acre, with an average of about $3.

Reeves County includes three distinct soil groups: (1) The upland soils of the outwash-plain region, (2) the residual soils derived from igneous and limestone rocks, and (3) first-bottom soils representing the recent alluvium. The soils range in texture from fine sand to clay, with silty clay loam predominating. The Reeves soils are the most extensively developed, the Verhalen soils being next in area.

Alkali was found in excessive amounts in many of the soils. Most of these salty areas probably can be reclaimed successfully by ditching and flooding. The Toyah soils are the best for alfalfa, whereas the Reeves and Pecos soils seem better adapted to cotton.

Irrigation is done by gravity systems, artesian wells, and pumping plants. The sources of gravity water are the Pecos River and springs and flood water in the Toyah Valley.

In general the soils of the Balmorhea district are very productive. The Reeves soils are productive but need organic matter. The Pecos soils are fairly high in alkali, but should be productive if reclaimed. The pasture land supports from 10 to 20 head of cattle per section.

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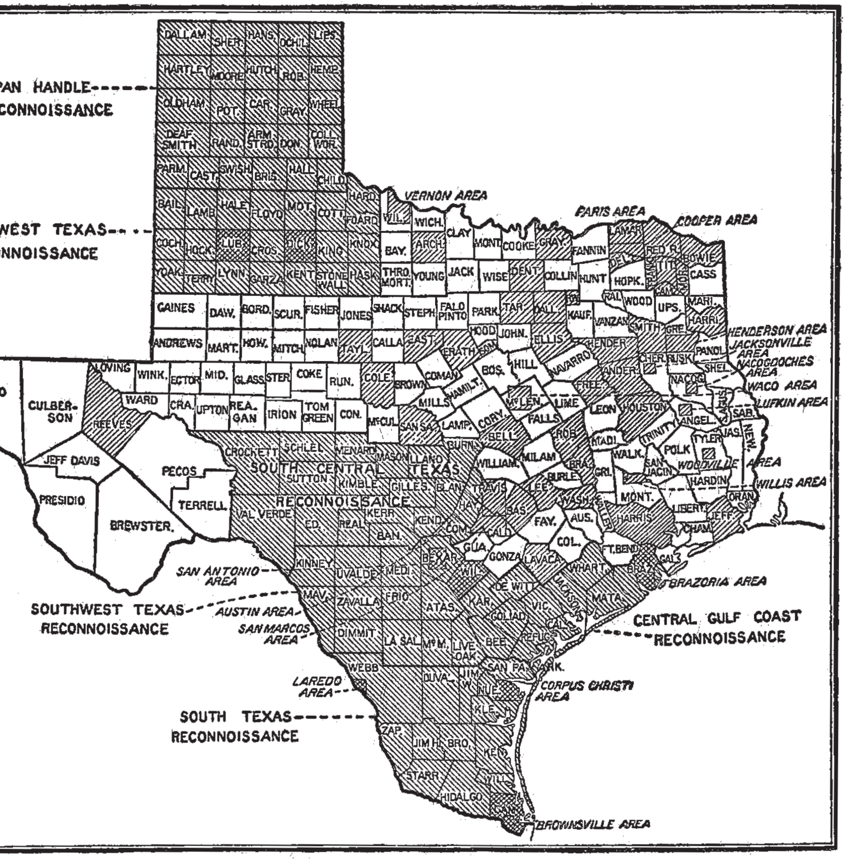

Areas surveyed in Texas, shown by shading

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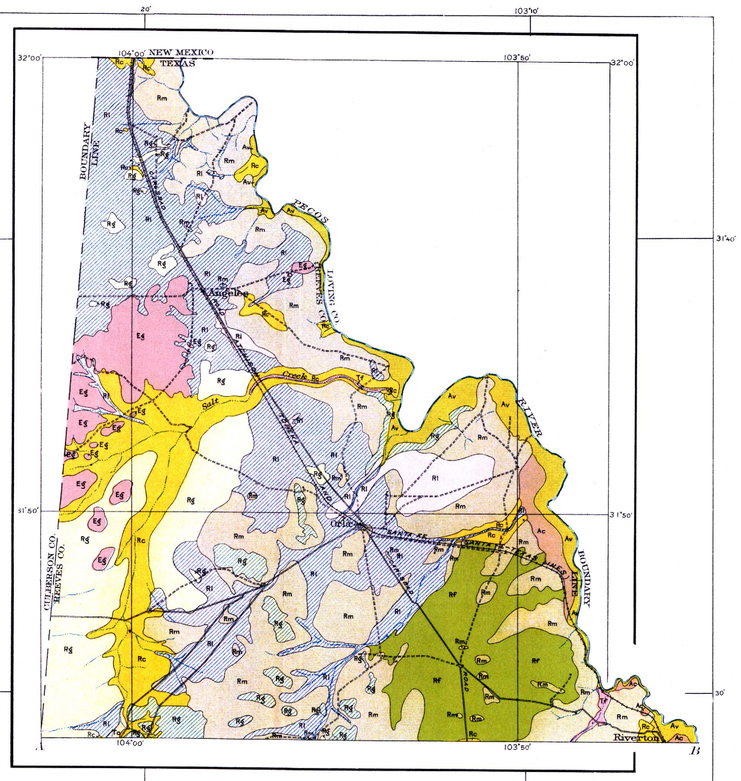
U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF SOILS
IN COOPERATION WITH THE
TEXAS AGRICULTURAL EXPERIMENT STATION

SOIL MAP

TEXAS
REEVES COUNTY SHEET



LEGEND

CONVENTIONAL SIGNS

CULTURE
(Printed in black)

- City or Village, Roads, Buildings, Wharves, Jetties, Breakwater, Levee, Lighthouse, Fort
- Secondary roads and Trails
- Railroads Steam and Electric (Double track, Single track, Not operated in part)
- Bridges, Ferry
- R.R. crossings, Tunnel (R.R. above, R.R. below)
- Ford, Dam
- School or Church, Cemeteries (CEM)
- Mine or Quarry, Mine dumps, Made land
- Bluff, Escarpment, Rock outcrop and Triangulation station
- Stony and Gravelly areas
- Soil boundaries
- Boundary lines (State, County)
- Boundary lines (Land grant, City or village)
- Boundary lines (Civil township, Reservation)
- U.S. township and section lines

DRAINAGE
(Printed in blue)

- Streams
- Lakes, Ponds, Intermittent lakes
- Intermittent streams
- Springs, Canals and Ditches, Flumes
- Swamp, Salt marshes
- Submerged marsh, Tidal flats

The above signs are in current use on the soil maps. Variations from this design appear in some maps of earlier dates.

LEGEND

Arno very fine sandy loam — Av	Reeves fine sandy loam — Rf
Arno clay — Ac	Reeves silty clay loam — Rl
Balmorhea clay — Bc	Reeves silty clay loam, Deep phase — Rl
Ector gravelly loam — Eg	Reeves chalk — Rc
Patrole silty clay loam — Pl	Toyah fine sandy loam — Tf
Pecos silty clay loam — Ps	Toyah loam — Tl
Pecos clay — Pc	Toyah silty clay loam — Tc
Reeves gravelly fine sandy loam — Rm	Verhalen gravelly clay loam — Vg
Reeves gravelly loam — Rg	Verhalen loamy fine sand — Vf
Reeves gravelly loam, Very gravelly phase — Rg	Verhalen clay — Vc
Rough stony land — Rs	Alkali — ●,17

Location of borings. The figure shows the average percentage of alkali present in samples taken to a total depth of six feet.

Soils surveyed by M. W. Beck, in charge, and W. W. Strike

Scale 1 inch = 2 miles

WILLIAMS-WEBB CO., WASH., D.C.

Field Operations
Bureau of Soils
1922